SCIENTIFIC AMERICAN

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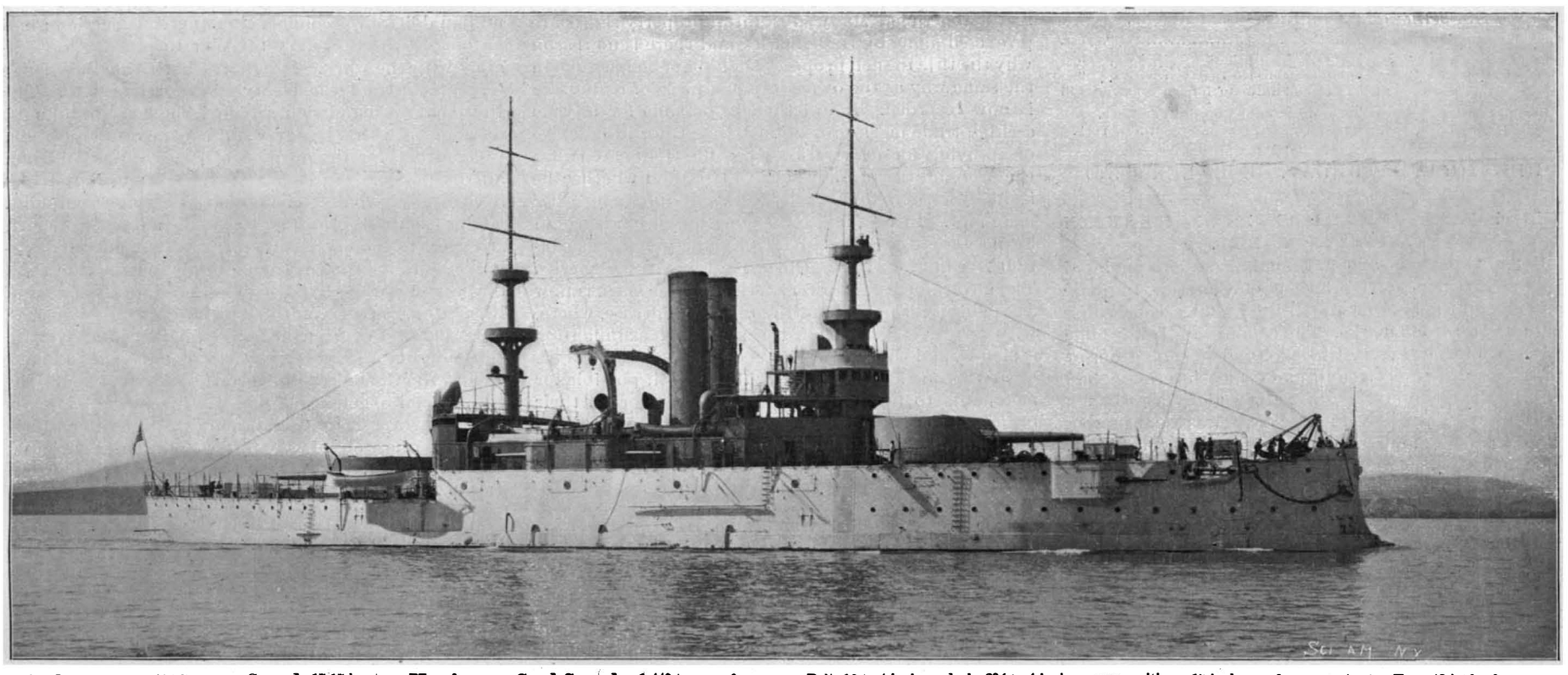
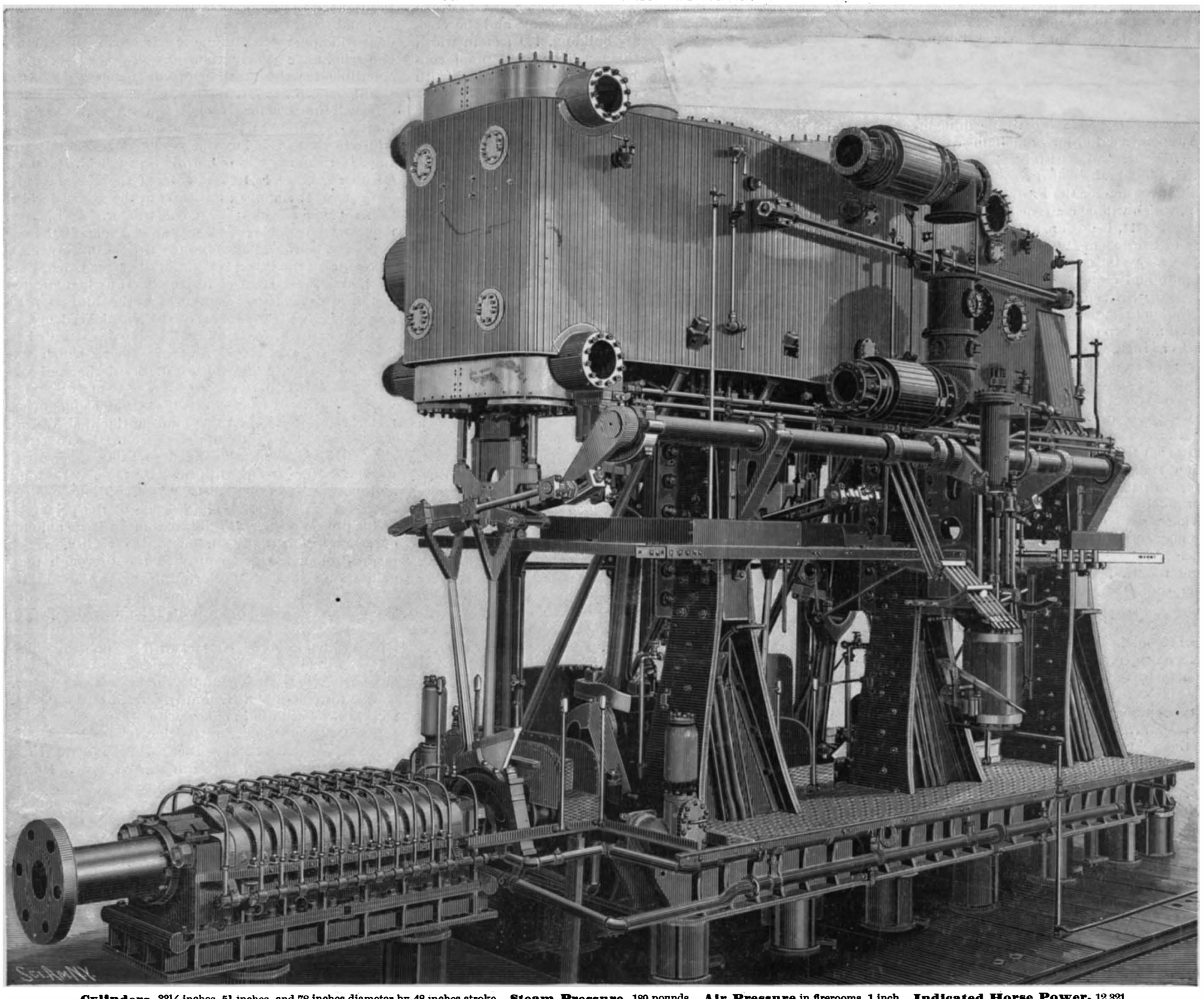


Displacement, 11,565 tons. **Speed,** 17·17 knots. **Maximum Coal Supply,** 1,440 tons. **Armor:** Belt, 16 to 4 inches; deck, 2¾ to 4 inches; gun positions, 15 inches. **Armament:** Four 13-inch; fourteen 6-inch rapid-fire; sixteen 6-pounders; four Colts; two 3-inch field guns. **Torpedo Tubes,** 4. **Complement,** 498.

UNITED STATES BATTLESHIP "WISCONSIN."



Cylinders, 33½ inches, 51 inches, and 78 inches diameter by 48 inches stroke. **Steam Pressure,** 189 pounds. **Air Pressure** in firerooms, 1 inch. **Indicated Horse Power,** 12,321.

ONE OF THE TWIN-SCREW TRIPLE-EXPANSION ENGINES OF THE "WISCONSIN."—[See page 358.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 8, 1900.

THE PATENT AND TRADE MARK COMMISSION AGREE ON A BILL.

Some two years ago a commission was appointed by the President, under an act of Congress, to revise and amend the laws of the United States concerning patents and trade marks. The commission held public sessions in New York, Chicago, and Washington, at which inventors, attorneys, and others interested had an opportunity of presenting their views as to such changes as they deemed necessary. The responses to a large number of circular letters were also considered. Since this time Mr. Francis Forbes, the chairman, Judge P. S. Grosscup, and Ex-Assistant Commissioner of Patents Arthur P. Greeley have been giving the subject their attention, and are now prepared to report at the coming session of Congress amendments of the patent laws, the object of which is to make them conform with the practice under the Convention for the Protection of Industrial Property concluded at Paris, March 20, 1883. The commission will report a new trade mark law.

This will be an epoch-making statute, and it will create much discussion between those who favor a "declaratory" trade mark law, making the registration a recognition of ownership, and an "attributive" trade mark law, which creates and may create ownership by registration even though the trade mark itself is not used immediately. The bill will be considered in a subsequent issue. The commission will also report several bills to amend the patent laws in minor details, relating especially to the filing of caveats and the appointment of foreign administrators.

Mr. Forbes and Assistant Commissioner of Patents W. H. Chamberlin sailed November 20 as delegates to the Convention for the Protection of Industrial Property, which will be convened at Brussels, Belgium, on December 11, being an adjourned meeting from that held in Brussels in December, 1897.

The above bills, especially that which relates to reforming and remodeling trade mark practice, will be watched with the greatest interest, not only by the profession at large, but by all those members of the community who have any property rights in trade marks as such. The present practice of allowing the owners of trade marks to use their own judgment as to whether they shall or shall not register their mark is the one feature of our trade mark laws which is not up-to-date, or in harmony with the progressive spirit of the time. Many of our readers may be surprised to know that there is no way by which the originator of a new trade mark can ascertain whether or not the device or name which he has conceived and adopted is original with him. He may go to some expense in having a search made in the Patent Office; his attorney may correctly advise him that as far as the Patent Office is concerned, nothing stands in the way of his using the trade mark he has adopted; and having taken the only precaution open to him in advance of actually putting the mark in use, he, perhaps, spends a considerable amount of money in having labels and imprints made bearing his trade mark. He puts his goods on the market, and perhaps expends large sums in advertising those goods. Some months or years may elapse before he receives a notification from some petty manufacturer that he must discontinue using the mark, and that he must be answerable for damages, as he, the petty manufacturer, had placed goods bearing the same mark upon the market ten or perhaps twenty years before. A case of this kind seems exceptional, but those attorneys who are actively engaged in practice are aware that this is an every-day occurrence. Prominent attorneys, know of cases where thousands and hundreds of thousands of dollars have been spent in advertising before it is discovered that the mark which had been so prominently put before the public is an infringement of a mark which is the property of some rival manufacturer. No recourse is open to the merchant under these circumstances. He is obliged to submit, perhaps, to the rather cruel terms of a rival, or he is obliged to discontinue the use of the mark and lose the benefit of his advertisements, and perhaps, in addition, to pay heavy damages for his innocent act.

How may evils of this character be corrected? It rests with the able body of commissioners appointed by the President to solve this problem, for certainly no greater evil exists to-day in our trade mark practice. It would seem that a law could be mapped out without any great difficulty which would correct these abuses and give the industrial classes relief from the present chaotic conditions. Probably the simplest method to correct the abuse is to frame a law extending trade mark protection only to those who shall register their trade marks in the Patent Office within a reasonable time. Many substantial property rights are protected alone by trade marks, and there is no reason why the title to such property should not be recorded in the same way as the ownership of a piece of real estate is now recorded. It will then be possible for anyone seeking trade mark protection to ascertain in advance of applying for registration what his rights are, what the probabilities of allowance will be, and whether he is likely or not to infringe the rights of some other merchant. In carrying out such a provision it would be necessary, of course, to modify the present exorbitant fees of the Patent Office for filing trade marks. The government fee for registering a trade mark is now $25. This is far in excess of the needs of the case, where, with proper classification, the matter of examination is simple, and the registration fee should not exceed $5, or at the outside $10. This will render it possible for merchants to freely register trade marks for all their brands of goods. We have every reason to believe that the Commission will have some plan to lay before Congress which will prove of great relief to the business community.

FIREPROOF DOCK CONSTRUCTION.

Evidently the lessons of the fire which swept out of existence the North German Lloyd docks at Hoboken have been laid well to heart by the company. The plans for the new docks show that pretty well everything that can be done to make the construction fireproof will be incorporated in the piers, pier sheds and terminals. The fundamental feature of the new plans is the erection of a granite and concrete sea-wall along the 900 feet of water front which comprises the property of the company, and the erection on this of a two story building, 130 feet in width by 850 feet in length, which will be of fireproof construction, the columns being filled and covered with concrete and both floors consisting of steel girders with brick arches turned in between. The lower floor will be devoted to cargo, and on the upper floor the passenger traffic of the arriving and departing steamers will be handled.

It is particularly in the construction of this building that the company have shown a wise appreciation of the awful extent of the fire risk which attends the crowding of a departure pier during the sailing of a steamer; for had the recent conflagration occurred when some 1,200 or 1,500 souls were scattered throughout the full length of the pier, it is probable that seventy-five per cent of the number would have been lost. To preclude the possibility of any such disaster, passengers will, for the future, be required to watch the departure of the steamers from the main building above described; and to provide them with a clear view of the vessel as she pulls out into midstream, a promenade with awnings has been arranged along the full length of the roof facing the river, an arrangement which will give a better view of the ship, and will place the passengers, in the event of a fire, in close proximity to the street. From the mainshore bulkhead building there will extend into the river three piers, respectively 910 feet, 894 feet, and 874 feet in length, the first two being 80 feet, and the third 90 feet wide. Although these piers will be built upon wood piling, they will be protected against fire by a concrete floor covered by planking and by a sheathing of oak on the outside of the pier reaching from below the water line to the deck, this sheathing being designed to prevent fire from attacking the pier from underneath. The pier sheds will be protected from fire by filling and sheathing the steel columns with concrete, and by covering the wooden walls of the pier entirely with tin, which will be locked and fastened so as to give the wood a complete protection. This form of slow-burning construction is considered preferable to an all-metal construction, which, as the last fire showed, will warp and bend if exposed to a fierce heat. Protection against a rush of fire through the interior is provided by three transverse fire walls on each pier and five brick fire walls in the bulkhead building. To these will be added an arrangement of automatic fire sprinklers on all floors, a cable system of automatic fire alarms with loose coils of the same cable laid over stored merchandise, and an independent system of fire hose and hydrants extending through all the buildings.

We would suggest here that in view of the fact that some excellent systems of wood fireproofing have been perfected, the North German Lloyd Company, if they have not already determined to do so, would add enormously to the security of the building by using only fireproofed wood, at least in the piers and pier sheds.

CONGRESS AND THE ISTHMIAN CANAL.

One of the first questions to come before Congress will be that of the construction of the Isthmian Canal. As that important matter now stands, the Hay-Pauncefote treaty is still subject to negotiation, and is now in the hands of the Senate; the President's Commission has yet to make its report; and the Hepburn Canal bill, which passed the House of Representatives last May, has yet to be considered by the Senate. This bill authorizes the President to acquire the necessary territory to build the Nicaragua Canal; appropriates ten million dollars for commencing the construction; and authorizes the Secretary of War to proceed immediately with the work. It ignores both the President's Commission and the treaty above referred to. The President's Commission, which is the largest and most distinguished that has ever studied the canal question, was sent out for the purpose of determining which of all the possible routes across the Isthmus is the best from a purely commercial and engineering standpoint.

This Commission, we understand, is about to report. If expert testimony counts for anything in our legislative halls, its word as to the location of the canal will be practically final. If it should report in favor of Nicaragua, there is nothing to prevent the work of construction being pushed through immediately with all the power and resources of the nation behind it. Should the Commission report that the Panama is the better canal to construct, and what is far more important, to operate, there would then come up for consideration the question of the terms of purchase required by the French owners thereof. If the Commission should recommend the Nicaragua route, there would be no such preliminary negotiations with an existing company to delay construction; the necessary rights, moreover, have been secured from Nicaragua.

THE CHIEF CONSTRUCTOR OF THE UNITED STATES NAVY.

The retirement of Rear-Admiral Philip Hichborn at the close of his second term as chief constructor of the United States navy, which will occur on March 4 next, leaves vacant one of the most important official positions in the administrative economy of this country; and we are much gratified to learn that the President will appoint from among our naval constructors one who, more closely than any other, has been responsible for the creation of our new navy and its maintenance in a state of thorough-going efficiency.

Naval Constructor Bowles, who, on and after the fourth of March, to the distinction of his new office will add that of being the youngest rear-admiral in the American navy, was born in Springfield, Mass., on October 7, 1858. In 1875 he entered the Naval Academy as a cadet engineer, but early in the course decided to become an assistant naval constructor. At his own request, made during his last year at Annapolis, he was sent for a course of study to the School of Naval Architecture at the Royal Naval College, Greenwich, England, and the system of instruction thus inaugurated has since come to be recognized as the highest prize attainable by the graduates of the Naval Academy.

On his return, in October, 1882, he was detailed as Secretary of the Naval Advisory Board, which was then charged with the control of the design and construction of the first ships of the new navy; and it was mainly due to his efforts that several ships of extremely questionable value and antiquated design, which had already been recommended for construction, were sufficiently modified to bring them up to the standard represented in the "Chicago," "Boston," and "Atlanta," the pioneer vessels of our modern fleets. With a thorough knowledge of the principles of his profession, Mr. Bowles combines a large amount of reorganizing and administrative ability, which made itself felt conspicuously in the thorough reorganization in 1886 of the Norfolk Navy Yard, and later in the reconstruction and equipment of the New York Navy Yard, Brooklyn, to which he was detailed in 1895. His general popularity has suffered only when he has come in direct contact with the political office-seeker, whose special qualifications have never found any harmonious setting under the system of administration instituted and rigorously carried out wherever Mr. Bowles has been in charge.

Unlike his successor, the retiring incumbent of the office, Rear-Admiral Philip Hichborn, is identified not merely with the new, but with the old navy. He received his commission as Assistant Naval Constructor in 1869 and his commission as Naval Constructor in 1875. In 1880 he was selected as a member of the first Advisory Board, from which, as we have seen, proceeded the early vessels of the new navy. In 1884 he was detailed to make a special tour of the dockyards of Europe, and his valuable report to the Department is considered a standard work upon the subject. In November of the same year he was ordered to Washington as Assistant to the Chief of the Bureau of Construction and Repair, and also as Naval Constructor at the Navy Yard, Washington. Mr. Hichborn was ap-

pointed Chief of the Bureau of Construction and Repair in September, 1893, and four years later he was reappointed for his second term, which is now drawing to a close.

It is fitting at this time to refer to the fact that the technical public is greatly indebted to the retiring Chief of the Bureau of Construction for the unvarying courtesy with which he kept the public informed, through the technical press, as to the plans and progress of the vessels of our new navy.

INTERNATIONAL CONGRESS OF RAILWAYS AT PARIS.

Among the most interesting of the papers read at the International Congress of Railways, recently held at Paris, is that relating to the electric railroads now existing in Europe, by Messrs. Auvert and Mazen, two prominent engineers connected with the French railroads. The authors describe in detail the leading railroads of Europe on which electric traction is used. The present abstract includes several of the most important systems.

ZERMATT-GORNERGRATT (SWITZERLAND).

This mountain railway was the first to use three-phase currents. The line, which was opened near the end of 1898, is an extension of the line in the valley of the Viège. It has a total length of five and a half miles, with a maximum grade of 20 per cent. Its construction has presented great difficulties. The track is 39 inch gage, laid upon iron ties. The rack and pinion system is used, with double rack between the rails. The generating station at Findelenbach has three horizontal turbines, fed by a 320 foot fall; each turbine is direct-connected to a dynamo of 250 horse power, one set being used as a reserve. The dynamos, of the Brown-Boveri type, have a fixed armature and revolving field and work at 40 cycles per second. The current generated at 5,400 volts is transmitted to three transforming stations, one of which is in the station itself and the other two at three and five miles along the track. Each of the stations has a transformation capacity of 180 kilowatts, and includes two groups of three transformers of 30 kilowatts. The two trolley wires are supported at intervals of 80 feet by cross-wires; the rail serves as the third conductor. For the traction, locomotives are used having each two motors of 90 horse power, independent of each other. The motors, fixed to the truck, transmit the effort to the main axles by a double gearing, whose ratio is 1 to 12; the motors are of the triphase non-synchronous type and have six poles, making 800 revolutions per minute, and are built to stand a considerable overload. Above are mounted the resistances for the motors and the various apparatus and instruments. The locomotives weigh 11·500 tons; their axles are 80 inches apart. Open and closed passenger cars and freight cars are used. The open cars have five compartments of 10 places and the closed cars contain 60 places.

STANSSTADT-ENGELBERG (SWITZERLAND).

This line is fourteen miles long, and is divided into three sections as to track; the first section, from Stansstadt to Obermatt, being in ordinary track, the second, from Obermatt to Gherst, in rack and pinion, and the Gherst-Engelberg section in ordinary track. In the first and last sections the average grade is 5 per cent, but in the middle section it reaches 25 per cent. The central station of Obermatt has two dynamos of 200 horse power and two exciters of 22 horse power coupled directly to horizontal turbines. The hydraulic power necessary has been obtained by using a number of small streams which flow into a covered reservoir connected with the station by a 10-inch cylindrical conduit of about one mile long. The height of the fall is about 1,000 feet. The triphase currents are produced at 750 volts and 65 cycles. The section next to the station is fed directly, and for the others a system of high tension distribution at 5.000 volts is used, with transformers at the substations to lower the tension to 750 volts. The current is taken to the motors of the locomotives and cars by two trolley lines 3 feet apart and 14 feet above the track. The rolling stock consists at present of two locomotives, five motor cars and four freight cars. The locomotives, which weigh 17 tons, serve to draw the freight trains and push the cars upon a portion of the steep grade. They are mounted upon two axles and carry two motors, which are connected by double reduction gearing to the pinion, which engages in the rack between the rails. The motors, of 75 horse power, give 650 revolutions, and the speed along the rack and pinion system is about three miles per hour; on the ordinary track it reaches seven miles an hour. The current is taken from the overhead line by wire loops. The motor cars are 45 feet long, and have 44 to 48 places; they are carried upon two trucks of two axles each. Upon one of the trucks are mounted two 35 horse power motors, making 480 revolutions, which are connected with the axles by gearing. The circulation over this route is effected as follows: From Stansstadt to Obermatt the distance is about ten miles; this section is traveled over by the motor cars, with a trailer at certain times. At Obermatt the rack and pinion system begins, and the car is pushed up the grade by the locomotive for a length of one mile to Gherst, after which the car runs upon an ordinary grade to Engelberg by its own motors.

METROPOLITAN UNDERGROUND RAILWAY AT BUDAPEST.

This underground road extends from the center of the city to the exterior limits at Varosliget. It was put in operation in 1896, being intended as the beginning of a metropolitan system. The line, like all the tramway lines of the city, is fed by a central station which supplies continuous current at 300 volts. The road starts from the Danube and reaches by a series of curves of small radius the southern end of Andrassy-Strasse, which the line follows in a straight line under the middle of the street. The total length of this line is about two miles of double track, standard gage. The heaviest grade is 2 per cent, but one curve of 130 feet radius has a grade of 18 per cent. On account of the numerous sewers below the street, the line was laid out so as to pass above these, so that the height between the rail and the iron structure upholding the pavement is about 10 feet. The axes of the tracks are 11 feet apart, and the width of the tunnel is nearly 20 feet. The iron framework is formed of I beams with vaulting between; the structure is consolidated by pillars placed 12 feet apart along the axis of the tunnel. The track is laid upon metal ties. There are ten stations, the platforms being 16 inches above the rail. They are reached from the street by staircases starting from a station erected on the pavement. The current is taken from two conducting rails suspended above the track; these are of steel and are fixed to the overhead beams upon insulators, being 3 feet apart. Each car carries two rubbing contacts which take the current. The central station which supplies this line as well as the other tramways of Budapest, is located in the city about half a mile from the nearest point of the road. It contains three units of 600 horse power (horizontal tandem compound engines coupled to Siemens dynamos giving 1,000 amperes and 300 volts); four units of 300 horse power (horizontal engines coupled to Siemens dynamos of 500 amperes); two units of 80 horse power used as a reserve. This gives a total capacity of 3,160 horse power, or normally 1,600 kilowatts. The rolling stock consists of motor cars of two trucks of a special construction. Two types are in use at present; the first, in which the motors act upon the axles by chain transmission (a type which will probably not be continued), and a second, in which the motors are mounted directly upon the axles. Each truck of two axles has a single motor of 30 horse power, giving a speed of 15 miles an hour. The car has a central space for 42 passengers and a cabin at each end for the motorman; the cars have a total height of 8 feet. The current is taken by horizontal bar contacts supported upon springs. An electric braking system is provided by reversing the current in the motor fields, transforming the motors into generators, and the current set up is sent into a series of resistances, which may be varied at will.

DUSSELDORF-CREFELD ELECTRIC RAILWAY.

This is one of the most important of the German electric railroads. It unites Düsseldorf on the left bank of the Rhine to Crefeld on the right bank, the distance being about 14 miles. The line is standard gage; at present it is single track for the most part, but is laid out so as to allow double track to be used later. From Düsseldorf the line crosses the river in double track over a wide bridge, and from Oberkassel, the village on the opposite bank, to Crefeld single track is used except at a few stations. The track is laid to take the rolling stock of the Prussian State railroads. This line was begun in the middle of 1897 and commenced operation at the end of 1898. On account of the competition from a neighboring parallel road, the new line was laid out for a speed of 24 miles an hour. The traction is effected by motor cars taking the current at 600 volts from two overhead wires. The generating station, situated at Oberkassel, supplies the road as well as a number of works in the vicinity. It has two engines of 270 horse power driving two direct current dynamos of 330 amperes and 600 volts, one group being used as a reserve. The cars are of the two-truck pattern, each truck having on one axle a 40 horse power motor, mounted directly. The cars are about 40 feet long and contain 50 persons in all. The authors describe the London Underground Systems, Jungfrau Electric Railroad, etc., and also the use of electric locomotives on the Paris-Lyons-Mediterranean road; the latter will be illustrated in a subsequent article.

REGISTRATION OF UNITED STATES PATENTS AND TRADE MARKS IN CUBA.

In our issue of November 24, 1900, we called the attention of American manufacturers and merchants to the necessity for registering trade marks and patents, so far as they have been extended to Cuba, in the Mercantile Register kept in that island. A penalty of $25 was fixed for failure to register within eight days of the extension of the patent or trade mark right to Cuba, but for patents and trade marks already extended, grace was given up to December 1, 1900.

We take pleasure in informing our readers that this excessively short grace has just been extended to the end of the current year, thus allowing American patentees and trade mark owners sufficient time to comply with the new regulations and to escape being fined.

LETTERS FROM PEARY.

Mr. Herbert L. Bridgman, secretary of the Arctic Club, has given out some extracts of letters to Mrs. Peary. They reached this country after she had started to go to her husband. They contain the first direct news from Lieut. Peary since August 28, 1898.

Mrs. Peary left Sydney, Cape Breton, on July 20, with her daughter, to join her husband at Etah, Greenland, on the "Windward." She was last reported at Disco, Greenland, on August 20. These letters from Peary were carried by natives to the camp of the Stein party at Cape Sabine, and thence conveyed to Cape York by Dr. Kahn, who boarded the steamer "Eclipse" on June 9, and was landed by her at Dundee, Scotland, on November 9.

It is an interesting fact to note that the lieutenant has not the slightest knowledge that his wife and daughter are on their way to meet him, although neither she nor any of his friends know just where he is now.

Neither he nor Mrs. Peary is aware of the death of his mother, which occurred three weeks ago.

The extracts from the letters follow:

FORT CONGER, LADY FRANKLIN BAY,
March 31, 1900.

Just a line to go down to a whaler by returning natives. I arrived here at midnight of the 28th, twenty-four days from Etah. Six and one-half days of this time we were held in camp by heavy windstorms. The doctor and Henson each left Etah with natives before we arrived here. The journey was a tedious one, owing to the storms, but not an uncomfortable one for me. A number of the dogs died on the way, but I had an ample number for the work ahead. Twenty-one musk oxen were killed in sight of the fort the day before I arrived, so we have an abundant supply of fresh meat.

After resting and feeding the dogs a few days longer, I shall go on with Mott and the best Esquimaus up the northeast Greenland coast. The doctor and the other Esquimaus will remain at the fort hunting. I am in good condition, and the journey shows me that I am myself again. If I do my work this spring, I shall come back and hasten down to meet the ship, and turn back with her. I hope to write again by natives whom I shall send back from some point up the Greenland coast. Dr. Diedrick wishes to be remembered.

CAPE D'URVILLE, GRINNELL LAND.

I write this note on the chance of Stein and Dr. Kahn reaching Upernavik by way of Melville Bay. The fall and winter passed comfortably at Etah without even a day's indisposition on my part. I have husbanded myself carefully. My feet have given me very little trouble, and now I feel that I am myself again. I am now at the "Windward's" winter quarters, with the rear division. Mott and the doctor are ahead, with two other divisions, all on the way to Conger. All but a few of the natives will return at once from there, leaving a few with me. I shall push on from Conger without delay, perhaps by way of the Greenland coast. 1 shall strain every nerve, and, God willing, shall do my work this spring, that I may come back this summer. I send duplicate of this to Cape York for a whaler. (Dated March 12, 1900.)

FAILURE OF THE DISPLAY OF LEONIDS.

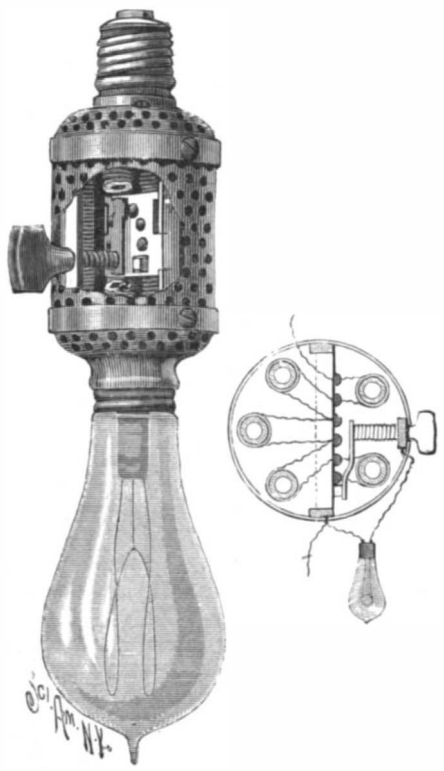
The display of Leonids this year has been very disappointing, only a few having been seen. It is probable that their orbit has become changed, taking them farther away from us. Assistant Prof. Wendell, of Harvard University, says that unless during the next thirty-three years there shall be another change in the orbit of the meteors, bringing them back near the earth, we shall see no more of the ancient November shower of Leonids. The few which have been seen this year were stray meteors which had wandered out of the regular path. The principal cause of the change in the orbits of the Leonids is that there has been some disturbance in space which has brought a large body near the path of the Leonids, thus exerting an attraction on them and causing them to change their orbit.

SUGAR INVENTIONS WANTED.

The Hawaiian Planters' Association has offered $6,500 in prizes to inventors of labor-saving machines to be used in the sugar business. Three machines are wanted, which planters think some one should be able to invent, and they are willing to pay for each. For a machine to cut cane the planters offer a prize of $2,000 to the man who submits the best plan. This sum will be increased to $5,000 if the design is accepted and proves efficient. A cane transporter and a machine to load cane into cars are also wanted, and for these planters offer $1,500.

THE BRUNT IMPROVED REGULATING INCANDESCENT-LAMP SOCKET.

A well-ventilated socket containing a rheostat by means of which any number of resistances can be thrown into the circuit, so that the light can be modified as desired, can evidently be employed to no little purpose in sick-rooms, vestibules, and sleeping-apartments. Sockets of this character are so ingeniously and compactly constructed that we have selected for illustration the latest and most improved type, made by the Brunt Porcelain Works, of East Liverpool, Ohio.



A REGULATING-SOCKET FOR INCANDESCENT LAMPS.

Within a perforated brass casing, an upper and a lower disk of porcelain are mounted. The disks are connected by a rectangular metal frame, notched to receive the projections of a miniature switchboard of porcelain. The disk is provided with a brass plug, screwing into the usual electric light socket; and the lower disk is provided with a screw-socket to receive the lamp. On the switchboard are six contact-points wired with five resistance spools, extending from disk to disk. The switch-arm which plays over these contact-points is carried by a spring-controlled shaft turned by a vitrified key, held in a brass bar extending between the two porcelain disks. The brass rectangular frame in which the switchboard is mounted serves as a direct conductor for the current from the live wires to the lamp. When it is desired to modify the light, the key is turned to throw one or more resistance spools in the circuit.

Accurate tests of the Brunt lamp have been made. A test made with a 61½ watt, 110-volt lamp, of 16 c. p., showed that by throwing in the various resistance spools, from 37 to 57½ watts were consumed and from 6½ to $39\frac{8}{10}$ per cent of the current saved. With a 52-volt lamp of 16 c. p. and 3·5 watts efficiency, 29 watts were consumed on the first contact-point and a candle power of 0·2 obtained; 32·5 watts were consumed on the second contact, and a candle power of 0·4 obtained; 36 watts were consumed on the third contact and a candle power of 0·7 obtained; 41·5 watts were consumed on the fourth contact-point and a candle power of 1·8 obtained; 48 watts were consumed on the fifth contact-point and 4·5 candle power obtained; and 56 watts were consumed for the full 16 candle power. The figures speak for themselves.

A NOVEL ELECTRO-MAGNETIC BRAKE FOR STREET CARS.

The British Westinghouse Company have recently acquired the patents of a novel electro-magnetic brake, invented by Mr. Newell, for utilization on street tram-cars. It consists of a horse-shoe electro-magnet, suspended on spiral springs, so that the poles hang directly above the rails. When the magnet is excited, it forces down these poles, so that the shoes grip the rail in a similar manner to the ordinary track brake. But there is a wide difference between the effects of the application of the Newell brake and those of the conventional track brake. In the case of the latter, the braking effect is obtained at the expense of the weight of the car; that is, by reducing the grip of the car wheels on the rails, and therefore nullifying to a considerable extent the effect of the wheel-rim hand-brakes. In the case of the Newell brake, however, by means of a simple arrangement of levers connecting the electro-magnet with the shoes of the wheel-rim hand-brake, the reaction of the shoes on the track results in an increased thrust or pressure on the shoes of the wheel-rim hand-brake. By this means an increased braking effect on the wheel-rims is caused, and the effective weight of the car on its wheels is not changed by the application of the track-brake.

Another important feature of this brake is that it is not actuated by the current supplied by the conduit mains, but by power produced by the loading of the car motors as generators. The momentum of the cars, after the supply circuit has been interrupted, drives the motors as generators, and it is the resulting current which furnishes the power for the electro-magnetic brake. By this it will be realized that the action of the brake is entirely independent of the continuity of the main electrical supply, and any failure of the current does not interfere with the braking of the cars. In fact, the brake is practically automatic in its action, since, immediately the supply circuit is interrupted, the brake begins to act. The proportion of the braking effects on any car produced by the shoes gripping the track and the increase of pressure upon the wheel-rim shoes is adjusted to the weight of the vehicle and the gradients of the track, so that the maximum pressure which will not cause skidding of the wheels may be applied to the shoes of the rim-brakes. With the Newell brake, when the weight of the car is 8 tons, 60 per cent of the power is applied to the rails, and the remaining 40 per cent to the wheels.

The brake is actuated by a backward motion of the controlling handle. It has been subjected to several tests upon the Westinghouse tram-car in London, and has been proved to be so effective and quick in action that cars may be more readily brought to a standstill than by any other existing type of brake.

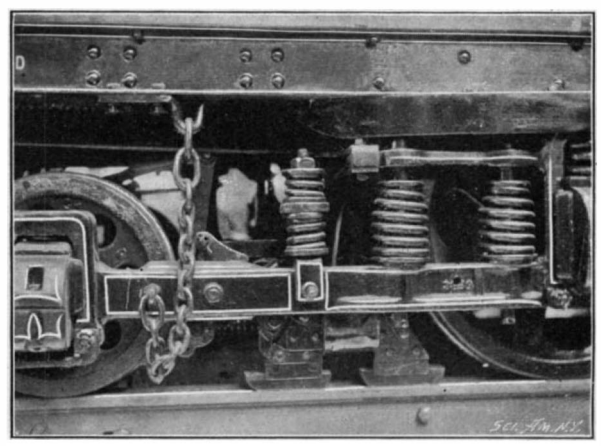
AMERICAN COAL BRIQUETTES.

Travelers in Europe are familiar with the coal briquettes which are used extensively in place of ordinary coal both in England and on the Continent, and the amount of smoke which they emit has probably impressed most Americans unfavorably, so that they would be slow to recognize their adoption in this country. The great amount of smoke which the briquettes yield when burned is due partly to the inferior sort of stoves in common use in Europe for heating purposes and to the fact that soft coal dust is used in their manufacture, with a large amount of pitch for binding material. If anthracite coal dust was used exclusively, with less pitch in the binding material, and the briquettes were burned in good American coal stoves provided with proper drafts and chimney flues, the smoking would be reduced to a minimum, and prove not much more annoying than when ordinary anthracite coal was used.

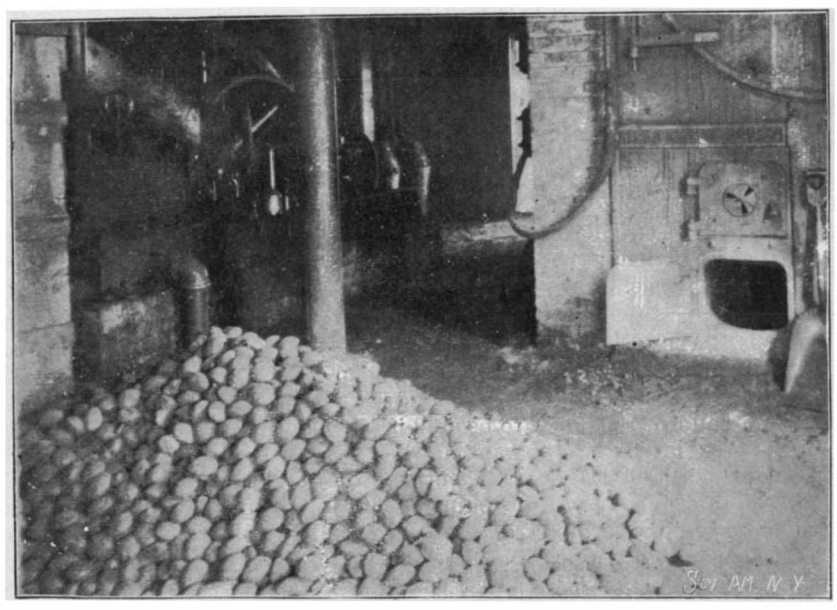
The advantages of coal briquettes are briefly their freedom from dust and dirt when handled, and their economy in utilizing coal dust and waste from the mines. The "slack" coal which is generally used can be worked up into briquettes and transported to any part of the country without much waste of any kind. Coal waste in this country has been enormous in the past. The vast culm heaps for years piling up at the mouth of every coal mine represented waste of natural material amounting to millions of dollars. It is only comparatively recently that this culm waste has been utilized for producing energy, and to-day mills and factories constructed with special grates and furnaces to burn this material have sprung up in the vicinity of the coal mines. With the cost of transportation reduced to nothing, these factories have found the fuel problem a simple one of solution.

Although these culm heaps were neglected for years, there were plenty of geniuses who realized that some day the waste fuel would be utilized; and since 1837 many patents have been taken out to make coal briquettes, most of them having in mind the culm that was accumulating at the mouth of every mine. The difficulties in the way of producing a handy, transportable fuel were many, and the attempts proved unprofitable for one reason or another. It was a foregone conclusion that coal briquettes would never be popular in this country without the elimination of the disagreeable features characteristic of the briquettes used on the other side.

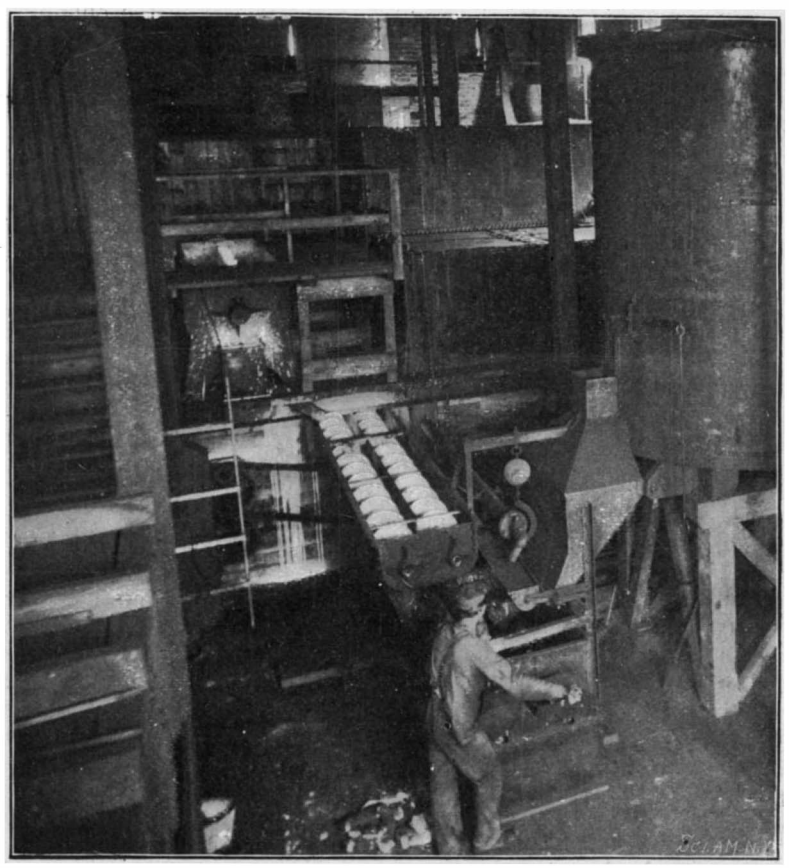
The successful manufacture of coal briquettes in the West to-day consequently proves of more than general interest as inaugurating a new era in our fuel problem that may have wide-reaching results. When we consider that the combined output of briquettes in Europe exceeds some 20,000,000 tons a year, and that they are used for house heating, for manufacturing purposes, and on the railroads and some of the ocean steamers, we can appreciate the extent to which a similar industry may develop in this country. In the American coal briquettes manufactured in the West to-day, the binding material has been mixed so that only five per cent of pitch is employed, with about two per cent of lime. The use of lime in the binding cement has made it possible to obtain good results with much less pitch



AN ELECTRC-MAGNETIC BRAKE FOR STREET CARS.



THE MANUFACTURE OF COAL BRIQUETTES—ENGINE AND BOILER ROOM.



THE MANUFACTURE OF COAL BRIQUETTES—THE MIXING MACHINE.

than the European manufacturers employ in making their coal briquettes.

This binding cement is one of the important features of the Chicago coal briquettes, and it marks the chief difference between the American and European product. The binding material was discovered through the experiments made in pressing various metallic ores into briquettes. Applied to coal dust, this cement proves much harder than that used in Europe, and consequently yields less readily to the disintegrating effect of the fire. By retaining their shape longer when burning, the American briquettes prove much more satisfactory from a heating and economical point of view. They also lose less from wear and tear in transportation and general handling. And finally the smoke nuisance is reduced to a point where it ceases to be an important factor in the question.

There is one large factory in Chicago which has been successfully manufacturing the American coal briquettes for several months, and with a daily output of 200 tons, or about 60,000 tons a year, the plant is probably the most representative of its kind in this country. The success of this Western plant has already started a similar movement in the East, and a second plant may soon be built near the Atlantic seaboard.

In Chicago, Illinois, soft coal is employed for the briquettes, with a slight quantity of anthracite mixed with it to give it more hardness, but on the Atlantic seaboard hard coal would have to be used to make the briquettes popular. The so-called "slack" coal of the mines is employed for this purpose, and after the slate and sulphur have been eliminated by washing and other processes, the coal is reduced to dust by means of powerful crushers manufactured especially for this work. These crushers are powerful enough to pulverize the most resisting substance that may be mixed with the coal, and nothing but dust of a fine, even texture comes from it.

The dust is carried from the crusher to a heater, where a temperatnre is maintained between 180° and 200° F. This heat is sufficiently below the igniting point of coal, and high enough to make the binder adhere firmly, to produce the desired results without in any way injuring or changing the chemical condition of the coal dust. An automatic elevator next carries the heated coal dust to the floor above, where it is mixed with the binder while still warm. The mixers are experts in their line, who know the exact proportion of different substances needed to make the briquettes hard.

The binding materials are contained in enormous tanks on this floor. In one huge tank there is slaked lime mixed with just sufficient water to make it thick and creamy. In a second tank there is a soft mass of bitumen heated to a temperature of 350°, while in the third tank there is cold bitumen. With these ingredients at hand the mixer performs his work according to formula. With weighing apparatus for each ingredient he fills another receptacle, capable of holding a thousand pounds, with the different compounds, until the right consistency is obtained. As the success of the whole process consists in the proper mixing of these ingredients, it is highly important that the measurements should be exact, and the work is performed under the supervision of competent experts. In this gigantic mixer the coal dust and the binding material are thrown by automatic machinery, and when they have been properly stirred and mixed they fall through an opening to the room below, where the powerful presses are ready to convert them into suitable sized briquettes.

The mixture, which is now about as thick as paste, is first fed into small moulds arranged on a wheel. As this wheel revolves with the paste in its pockets, a second wheel meets it with indentations to correspond to the first. The two come together so that an enormous pressure is exerted, and the briquettes are squeezed by a force equal to five tons to the square inch. This great pressure moulds the briquettes into solid, compact masses, and when they are dropped out they are nearly as hard and firm as bricks. At present the size of these briquettes is about equal to small egg coal, and they weigh between five and six ounces each. They are adapted to use in ranges, furnaces, and the open grate. The size and form, however, are merely arbitrary, and the moulds can be made to suit the demand of any special grate or furnace. New moulds can be made and substituted for the present ones very easily. It is simply a matter of making new wheels and putting them in the place of the present ones.

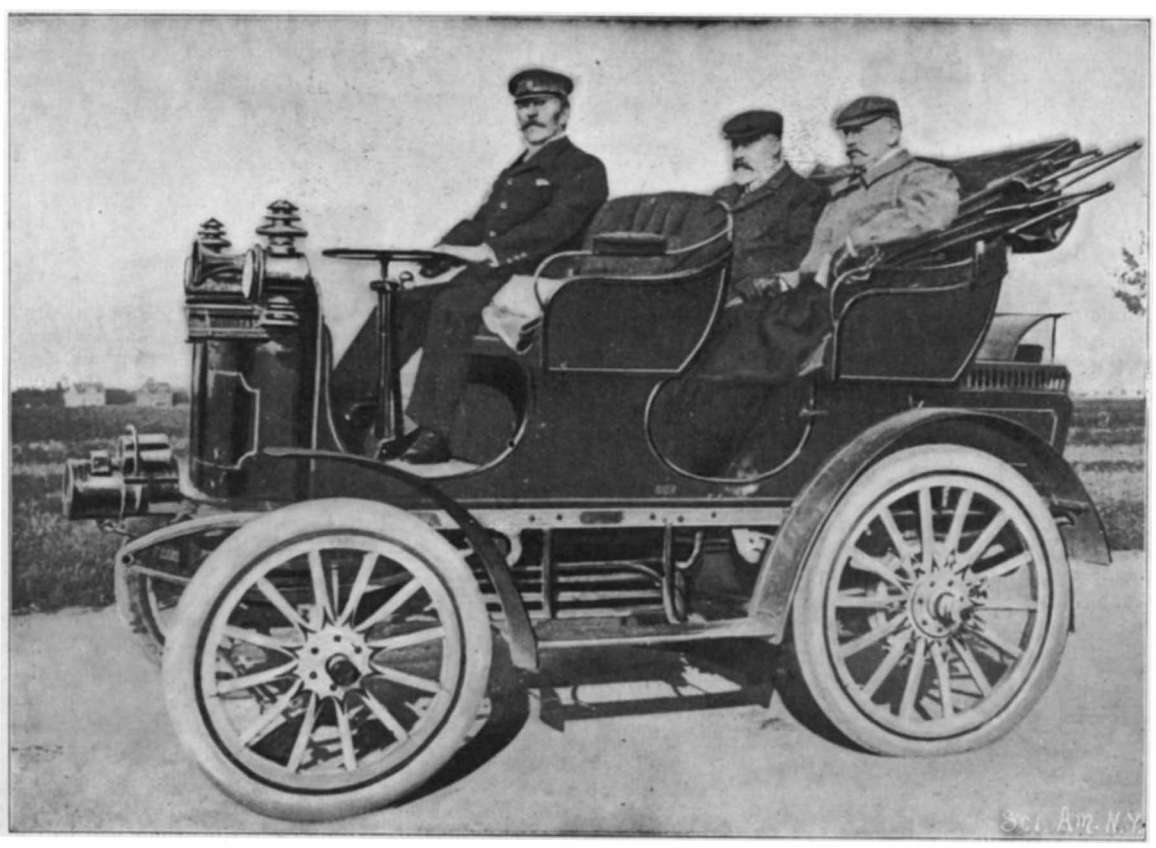
The great improvements recently made in coal-washing machinery now make it possible to produce briquettes from washed coal screenings at an extremely low cost. In addition to the ordinary briquettes, for use in the home furnaces for generating heat and in locomotives and factories and mills for producing steam power, a special size briquette will be manufactured for marine purposes. This is made with the idea in view of utilizing every available space in the storage rooms of a steamer. These marine briquettes are in the form of bricks of a rectangular shape, and they can be stored so compactly that a ton will occupy only 23 cubic feet. Specimens of these marine briquettes have been submitted to the Navy Department, and suitable tests will be made. For this purpose the coal will be washed to eliminate all sulphur and all chances of spontaneous combustion, saving thereby in storage capacity and cost. On the Western railroads, especially on the Illinois Central Railway, tests have been made with the soft-coal briquettes, and the results are so far satisfactory that the demand for them is greater than the present supply.

Preparations are being pushed now for starting two or three coal briquette manufacturing plants on the Atlantic coast, and before spring these will be in full operation. The coal dust of the anthracite mines will be used for making the briquettes in the Eastern factories. In Pennsylvania these dust heaps amount to millions of tons, which washed and loaded on cars can be purchased in unlimited quantities as low as ten cents per ton at the mines. In the West and South the briquetting of the lignite coal and soft coals, that will not bear transportation, promises to be the most successful, and this coal can be used without producing smoke or cinders to any appreciable degree.

THE SHAH OF PERSIA LEARNING HOW TO OPERATE A SERPOLLET CARRIAGE.

THE SERPOLLET STEAM AUTOMOBILE.

Among the new automobiles to be seen in the Transportation Palace of the Champ de Mars was the steam automobile invented by M. Serpollet, the combustible being ordinary petroleum. The Serpollet system of steam generators has been already applied to a number of the tramway systems of Paris and other cities. The inventor, who is one of the pioneers in steam traction, has recently perfected a system of steam automobiles which has attracted considerable attention among engineers and sportsmen. The Shah of Persia, on a recent visit to Paris, was greatly pleased with the new machines, and purchased one for his own use. One of the illustrations represents the Shah taking lessons in driving the machine from M. Serpollet. The Shah was so well pleased with the vehicle that he conferred upon the inventor the Order of the Lion and Sun. Another engraving shows the Prince of Wales in his double-seated phaeton of eight horse power, the view having been taken during a recent excursion in Germany.



H. R. H. THE PRINCE OF WALES IN A SERPOLLET CARRIAGE.

The mechanism of the system consists essentially of a spiral tube boiler, a four-cylinder engine, and an automatic feeding device. The boiler is constructed upon the same principle as that now in use in the steam tramway system, this consisting of a flattened copper tube of very small opening and thick walls, coiled into a spiral; for the tramway boilers the tube is heated by coke, but for the automobiles a special form of petroleum burner is used. When water is forced into the tube, the vaporization is instantaneous; and as the walls of the tube are very close together, the water cannot assume the spheroidal state, and thus all danger of explosion is avoided. The petroleum burner has been constructed to produce an especially hot flame with the use of ordinary oil, and to this end

it is conducted under pressure to the burner, where it is volatilized and mixed with air, forming long blue flames like those of a Bunsen burner; the petroleum is thus entirely consumed without odor or smoke. The burner is first heated by a small quantity of alcohol, and when sufficiently hot to vaporize the petroleum, the latter is turned on and produces the flame. The boiler is not subject to deposits, on account of the rapidity of water circulation, and by the cleaning out which may be given by allowing a violent back rush of steam and water.

The circulation is so arranged that the expenditure of petroleum and water and the steam pressure are always a function of the force to be produced. The arrangement of the parts will be seen in the diagram, which shows the water and oil reservoirs, and the boiler in the center; below the boiler, at *P* and *P'*, are the automatic oil and water pumps with their valves, *S* and *S'*. To the left is the water pump for starting, *P*, with its lever, *L*, and valve, *S''*. At *C*, below, is a series of eccentric disks which operate the pumps by means of the lever arm. The petroleum arrives under pressure by the tube, 2, and is forced by the pump into the burner, 4. The water, forced by one of the pumps into the tube, *c*, goes from there either to the boiler or to the regulating valve, *K*. The steam from the boiler goes to the engine by *e* and has a branch to the regulating valve; the latter communicates with the reservoir by the tube, *m*. As long as the steam pressure is not above the normal, the valve is out of action, and all the water from the pump is sent to the boiler; but when the pressure below the piston reaches a certain point, it is forced up and makes communication between *F* and *m*, and part of the water is returned through the valve to the reservoir until the steam pressure falls again to the normal. The valve has a handle at *M* which serves to empty the boiler by allowing a back rush to the reservoir.

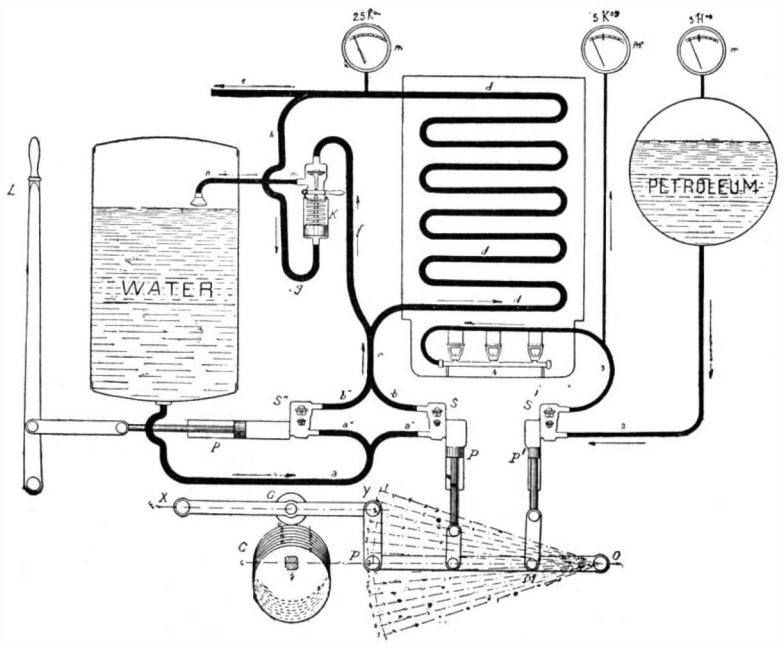


DIAGRAM SHOWING THE CIRCULATION OF FUEL, WATER AND STEAM.

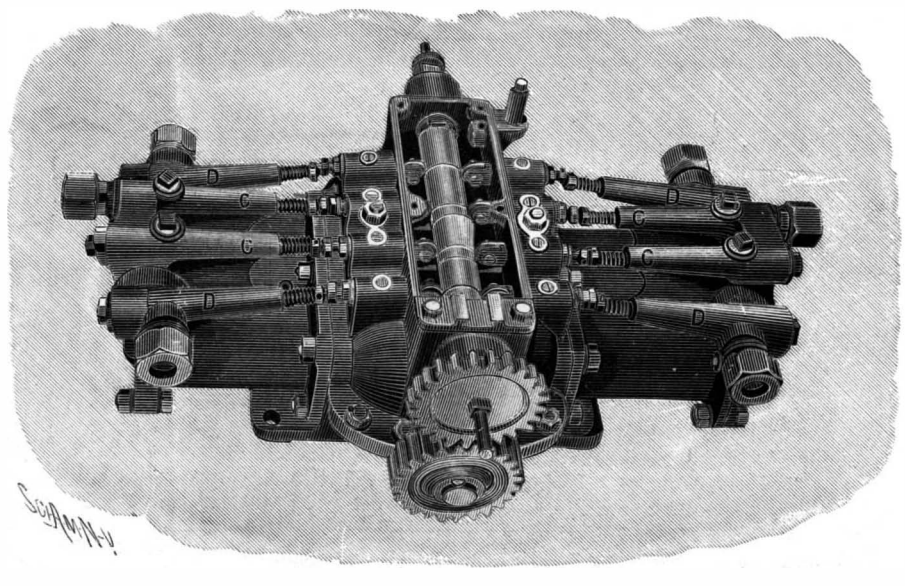
One of the essential features of the system is the arrangement by which the production of steam is varied according to the work required of the motor. The boiler is constructed of tubes which contain but little heat-reserve, and it is necessary that the production of heat at the burner should vary with the water supply. The water and oil pumps are connected by the lever, *M*, which is worked by a cam formed of a series of eccentric disks, *C*, and the series may be displaced laterally to bring the disks successively under the roller, *G*, of the arm. The first disk is concentric, No. 1 is eccentric by 0·1 inch, No. 2 by 0·2 inch, and so on, and the result is that the stroke and output of the pumps depend upon the disk which is under the roller, the set of disks being displaced by a controlling lever. As the oil and water pumps are connected to the same lever, the heat produced by the burner is always proportional to the water feed, the relation having been established once for all by knowing the quantity of water which a gallon of petroleum can transform into superheated steam. This arrangement is very simple and strong and does not get out of order, and the driver is not required to look after the intensity of the burner, which always corresponds to the amount of steam needed. The motor is shown in our engraving. It has two cylinders on each side, these being similar in construction to those of a petroleum motor, the use of stuffing boxes being entirely dispensed with. The four piston rods operate the crank-shaft in the center, this being inclosed in the case and running in oil. The eight valves, *C*, *D*, are external and their rods are operated by rollers worked by a series of cams on the upper shaft, which is arranged in concentric and eccentric portions and may be displaced laterally by a lever to vary the action of the valves at will; thus at rest the cylindrical portions are opposite the rollers and no effect is produced. For the starting, the shaft is pushed to the back and only one set of valves is operated, the others being then successively thrown into action. The motor may also be reversed by the same arrangement. The movement of the motor is transmitted by the second gear to an intermediate shaft containing a clutch, which allows full or mean speed of the vehicle.

The oil reservoir receives a constant pressure from a small air pump. The vehicle is started by working the lever of the supplementary water pump, *H*, which serves to inject a small quantity of water into the heated boiler, where it is transformed into superheated steam and starts the motor, which then works with its normal supply. The steam passes from the boiler into a main valve, which is controlled by a foot pedal in front and is normally closed; by this arrangement the conductor is sure that an accidental start will not be made if he leaves the vehicle, and, besides, the motor is thus always under control. To slow up the vehicle in crowded places or to avoid obstacles, the steam admission is diminished by raising the foot from the lever. The steam goes from the motor to the cleaning boxes and to the condenser, which is formed of a series of long copper tubes. The water of condensation is returned to the reservoir. The conductor has before him the levers for the pumps, the feeding cams, and the valves of the engine, as well as the necessary pressure gages. The transmission is made by a differential and chain to the rear wheel of the vehicle.

The operations of starting and controlling are quite simple. A small quantity of alcohol is used to heat the burner, which takes about five minutes; then by the small pump a pressure is made in the oil tank and the cock opened to the burner, which lights up with a blue flame, and the boiler is heated up in two or three minutes.

The conductor places the clutch in the middle position, which disconnects the motor from the vehicle and regulates the motor to the starting position, then puts his foot on the admission pedal, starting the motor with the least pressure and heating the cylinders, the oil and water feed working but slightly. When the cylinders are heated, which takes but a few strokes of the piston, the clutch is thrown on the full or mean speed and the feed-pumps placed at a maximum, continuing to feed by hand until the vehicle reaches a certain speed by the automatic feed, which is then regulated as desired.

In going down grades the feed is thrown off and the burner turned down; it is then brought to a maximum and lowered again to the right point. To slow up the vehicle, the conductor removes his foot from the pedal, which stops the motor instantly, and the brakes are applied.



MOTOR OF THE SERPOLLET STEAM AUTOMOBILE.

A COMPANY has been formed in New York to work the sulphur mines in the Taccorah Mountains, a distance of eighty miles from the seaport of Arica, Chile. The plans of the company are still in embryo, but New York is to be the receiving depot for the output. To establish refineries at Arica would mean investment of the greater part of the capital; the transportation of machinery and of coal would also be a matter of great expense, it is therefore possible that the raw sulphur will be taken to New York.

THE FIRST-CLASS BATTLESHIP "WISCONSIN."

The first-class battleship "Wisconsin," recently completed by the Union Iron Works, possesses interest for our readers from the fact that she was built in the yard which turned out the famous battleship "Oregon." The latter vessel, like the "Wisconsin," is one of a class of three ships, and like her she is the fastest in her class. The "Alabama," the "Illinois" and "Wisconsin" were authorized on June 10, 1896. The first-named vessel was allotted to the Cramps, of Philadelphia, and has already undergone her trials with great success, achieving a speed of 17·01 knots an hour. The "Illinois" is approaching completion at the yard of the Newport News Shipbuilding Company, and the "Wisconsin" has recently completed her official trials, on which she made an average speed or 17·17 knots per hour. The principal dimensions of the vessel are as follows: Length, 368 feet; beam, 72 feet 2½ inches; mean draft, when the ship is fully equipped ready for sea, with all stores on board and a normal coal supply of 800 tons, 23·6 feet. The displacement of the vessel with two-thirds of ammunition and two-thirds of stores on board is 11,565 tons. Her bunkers have a maximum coal capacity of 1440 tons. She is propelled by twin engines, one of which is herewith illustrated as it appeared in the shops of the Union Iron Works previous to being erected in the ship. They are of 10,000 estimated indicated horse power, although this was considerably exceeded on the trial trip, when the maximum indication reached 12,322. They are of the inverted three-crank, triple-expansion type, and while they conform broadly to the specifications drawn up by the Naval Bureau of Engineering, the builders have introduced specialties of design, which they have already used with marked success in other naval vessels built for the government. The most noticeable of these is the framing of the engines, which is formed of forged built-up columns at the back, and turned columns for the front side of the engine. The forged column is of a type which was first used by these builders in the engines of the "Olympia," and later in those of the battleship "Oregon." It is built up of forged plate sides, on which are flanges for securing the column to the bedplate and to the cylinder bottoms. Between the sides is bolted in the casting which forms the main guides, and below the guides the sides are spread, and a web-plate is worked in, the lower half of the frame being thus in the form of an inverted Y. It is claimed by the builders that this type of frame provides unusual rigidity, and the forged iron is more reliable than the material of the usual cast steel frames. The high-pressure cylinder is 33½ inches in diameter, the intermediate 51 inches, and the low-pressure cylinder 78 inches in diameter, the common stroke being 4 feet. The crank shaft is made of three interchangeable and reversible sections; the crank pins are 14¾ inches in diameter by 17 inches long; and there is a 7½-inch hole axially through the shaft and crank pins. The thrust shafts are 14 inches in diameter, and the propeller shafts 14¾ inches in diameter, with a 9¾-inch axial hole throughout their entire length, except in the after section, where they pass through the hub of the propeller, in which portion the hole is tapered.

The engines are fitted with straight-push, reversing gear, and the air pumps are independent of the main engine. The main circulating pumps, which supply the condensers, may be used to empty the bilge of the ship, for which purpose they have a capacity of 12,000 gallons per minute. The screw propellers are three-bladed and are made of manganese bronze. They are 15½ feet in diameter and the pitch is 17 feet 6 inches. Steam is supplied by eight single-ended steel boilers in four compartments; the boilers are 15 feet 6½ inches in diameter and 10 feet in length.

The "Wisconsin," as will be seen from our photograph, which was taken as the vessel was returning from her official trip, is a fine, seaworthy vessel with a good freeboard of about 20 feet forward and 13 feet aft. Her main battery of four 13-inch breech-loading rifles is carried in two barbette turrets; the barbettes are plated with 15 inches of Harveyized steel, and the turrets with 14 inches. She has a waterline belt from 7 to 8 feet in depth, which varies in thickness from 16½ and 9½ inches at top and bottom respectively amidships to 4 inches at the stem. This belt extends as far aft as the after barbette. With this armor is associated a steel deck 2¾ inches in thickness on the flat, 3 inches in thickness forward, and 4 inches from the after end of the armor belt to the stern. The main rapid-fire battery consists of fourteen 6-inch rapid-fire guns, ten of

which are carried on the main deck and four on the spar deck. Of those on the main deck, eight are carried within a central citadel, which is protected with 6 inches of Harveyized armor, the armor extending in the wake of the guns and running across at the ends of the battery diagonally to a junction with the 12-inch armor of the barbettes. The two other guns on the main deck are carried well forward in sponsons armed with 6 inches of Harveyized steel. The four guns on the spar deck are carried immediately above the central rapid-fire battery and are likewise protected with 6 inches of armor. The secondary battery is made up of sixteen 6-pounders, six 1-pounders, four Colts and two 3-inch field guns. There are also four Whitehead torpedo dischargers. The total complement of officers and men will be 493. Considering that the keel of the vessel was not laid until February, 1897, it is evident that improved facilities are enabling our shipbuilders to turn out these big vessels more rapidly than they could when earlier vessels of the "Oregon" type were built.

Automobile News.

Columbia University is the first college to have an automobile club.

A race from Paris to Berlin will be held by the Automobile Club of France, and the German Emperor has offered prizes to the value of 50,000 francs.

The reports of the French trials of heavy vehicles show that British makers are ahead of French manufacturers as regards this particular type of car.

The automobile drivers of Chicago are forming a union for those who handle vehicles for electric motors. Gas, oil and steam automobiles are not included.

The next automobile and cycle show of Paris will be held in January at the Grand Palais of the Champs Elysées. The building is a magnificent one for the purpose.

An automobile service will be established between Sea Cliff, L. I., and its railway station, a mile and a half distant, as the attempt to establish a trolley line has ended in failure.

Permission has been given to the New York Electrical Vehicle and Transportation Company, owners of the Fifth Avenue stage line, to change their motive power and extend their route.

C. Kirk Eddy, of Saginaw, Mich., was thrown with great violence upon the asphalt pavement when his vehicle was pushed into the curb while going at a high rate of speed. His death occurred on November 11 from the injuries which he sustained.

Ferry employes of the ferries around New York have to inspect each automobile to see how it is propelled, and if gasoline is the motive power the operator is told that he cannot cross the ferry until he has emptied the gasoline tank. This is in accordance with Section 4472 of the United States Revised Statutes.

A new electric automobile bell has been devised. The magnet incloses a coil, and the hammer is a steel rod, which has a reciprocating motion through the axis of the magnet. The latter is inclined at a slight angle, which causes one end of the rod to strike one peal, the other end on its return striking the opposite bell. As they are differently tuned, the tone produced is harmonious. The bell can be controlled by pushes on the ends of the controlling lever.

In connection with the run to Southsea, Mr. A. Harmsworth has offered a five pound cup for the motor vehicle which, in the opinion of the judges, may, on its arrival at Southsea Common, be the most presentable and cleanly as regards general appearance, says The Motor Car Journal. Mr. Harmsworth is of the opinion that the public become prejudiced against automobiles by seeing them arrive in town smothered in dust and looking generally disreputable. The automobile drivers do well to show pride in the appearance of their carriage, and to remove the dust and the other stains of travel from themselves and their vehicles before entering towns.

It is stated that a movement is on foot to do away with automobile shows. The reason for the step is to be found in the experience of bicycle manufacturers. As long as a few of the leading makers engaged spaces at the show, all of the others felt obliged to be represented. This results in a heavy expense. A plan has been formulated for starting a train of automobiles around the country, beginning next March. The train will visit all cities of consequence and remain from one to four days in each, in order that the residents may inspect the automobiles and have their merits explained to them. It is thought that this will benefit the industry to a greater degree than can be accomplished by holding shows, and the expense would not be greater than in going from one show to another.

THE Pollak-Virag system has been improved so that instead of signals being received in the form of a wavy line, similar to that traced by the siphon recorder, messages can now be actually printed on the paper in ordinary round-hand Latin characters at the rate of a thousand words a minute.

Science Notes.

There are 2,009 medical students in the city of Naples, 780 in Turin, and 530 in Rome.

Prof. S. P. Langley had the honorary degree of Doctor of Science conferred upon him by Cambridge University, England, on October 11.

The Duke of Abruzzi has given his exploring vessel, "Stella Polare," to the Italian navy. It will be stationed at Spezia and kept as a souvenir of the trip.

There are few countries in the world where American made playing cards are not found. They are attaining remarkable popularity in the far East, Japan liking them particularly.

Condensed milk wafers are going to be used in connection with the emergency ration test in Oklahoma. It is thought that condensed milk food will give better success than chocolate, which has been found to be of little service during the first test, which has just been completed. The milk food is made up in the form of wafers. When dissolved with water, it forms a kind of soup.

M. Rozé, of Paris, has devised a new type of airship. It consists of two huge cigar-shaped balloons placed in juxtaposition and tipped with aluminium. The car, capable of accommodating eight persons, is suspended from these aerostats. The airship is provided with two propellers, one forward and one aft, and the vessel carries a twenty horse power gasoline motor, to develop the necessary power for driving these propellers. The trial trip will take place next month.

The following remarkable statement comes from Consul-General Hanauer, of Frankfort. He says that M. De Gall, inspector of forests at Lemur, France, has invented a process for melting wood. By means of dry distillation and high pressure, the escape of developing gases is prevented, thereby reducing the wood to a molten condition. After cooling off, the mass assumes the character of coal, yet without showing a trace of the organic structure of that mineral. The new body is hard, but can be shaped and polished, is impervious to water and acids, and is a perfect electrical non-conductor. If the inventor can make a satisfactory substance of this kind, it will undoubtedly have a considerable future.

The greatest drawback of the incandescent gas lamp mantle is its liability to break, owing to its fragile nature, under the effect of the miniature explosions which occur whenever the gas is lighted or extinguished. To preserve the mantle from any disruption by this means a device has been invented by a gentleman in London, consisting of a movable ring cover, placed over the air holes of the burner. This cover is carried upon a sliding pin, which makes contact at its lower end with a cam projection from the tap lever, in such a manner that the air holes are closed by the ring when the gas is not alight, and they are not opened to their full extent until the flame has been ignited. In turning off the gas supply the air holes are closed before the flame is extinguished.

At the Egyptian Hall in London one of the principal items of the cinematograph exhibition is a film of the last solar eclipse, taken at the station in North Carolina by Mr. J N. Maskelyne, of the Royal Astronomical Society. The films give a very interesting idea of the character of the eclipse, and the inner coronal ring long previous to and after the totality of the eclipse is reproduced with great distinctness. The photographing of the slender partial phases and the corona, in order to obtain correctly graduated exposures upon biographic films, necessitates the placing of a thin wedge of yellow glass, backed by a similar wedge of plain optical glass, in front of the film, so as to move longitudinally. The camera is provided with a small ruby glass window, and through this the operator is able to follow the diminishing eclipse crescent, and to maintain the regular intensity of the image by gradually moving the wedge along.

The Public Health Department of the London County Council has issued to its medical officers a memorandum regarding the signs and symptoms of the bubonic plague, specially prepared by Dr. James Cantlie, who was connected with the plague hospitals at Hong Kong, and whose valuable services have been secured by the London authorities in case the epidemic should visit the city. The rat has generally been described as a potential means of distributing the disease, but according to Dr. Cantlie's investigations upon this subject, it is not so much the animal itself that spreads the virus abroad, but the insect parasites that infest its coat. When the rat has been killed, these parasites forsake the animal and seek refuge upon any persons in the vicinity. If they are not immediately expelled by hygienic methods, they will irritate the skin, and the scratching of the irritation, which necessarily follows, frequently causing abrasions, permits the bacilli to be infused into the blood. Consequently immunity from attack by these pestiferous parasites can only be assured by careful personal cleanliness, since it has been conclusively proved in the hospitals that the disease cannot thrive where strict hygiene is maintained.

Engineering Notes.

The rise in the price of fuel on the Scottish railways during the past half year was no less than 58·8 per cent.

The Great Northern Railway Company is building at Superior, Wis., a steel grain elevator with a capacity of 2,500,000 bushels.

A number of bloodhounds has been purchased for a western railroad in order to pursue train robbers. They were bought from the Idaho penitentiary.

Thirteen thousand seven hundred and five tons of coal were hoisted recently in twenty-two hours on the Toldeo docks of the Hocking Valley Railroad.

The old "Pavonia" and "Cephalonia" of the Cunard line, which are landmarks on the line between Boston and Liverpool, have been sold. It is said that the former was sold to an Italian shipping firm for $77,000.

In Russia every shop building has its holy picture and lamp, and it seems odd to an American to think of religious services being held in boiler and machine shops as they are occasionally in Russia. The Locomotive Engineering recently had an illustration of one of these pictures.

American exports in New Zealand are rapidly increasing, specially hardware. The American firms have wisely adopted the plan, which lies at the base of all successful export trade, of supplying what the colonies desire and not trying to force on them whatever the manufacturers wish to sell.

The French Minister of Marine recently made a tour of the harbor of Toulon in the submarine vessel "Gustave Zede." He also made an exhaustive examination of the internal mechanism of the craft, and declared that it was as perfect as present submarine science could make it.

The contractors who are carrying on the new national harbor works at Dover (England) recently accomplished a fine piece of work in deep-sea laying. The present Admiralty pier, which is about 1,000 yards in length, is being extended seaward, and forty blocks, each weighing forty tons, were laid in a single day.

In the new switch tower in the Grand Central yard, New York city, the windows are of green glass. It is a great protection to the eyes of the employes, and enables them to keep their vision at its normal strength at all times. The switch tower contains 176 levers, which operate the switches and signals by compressed air.

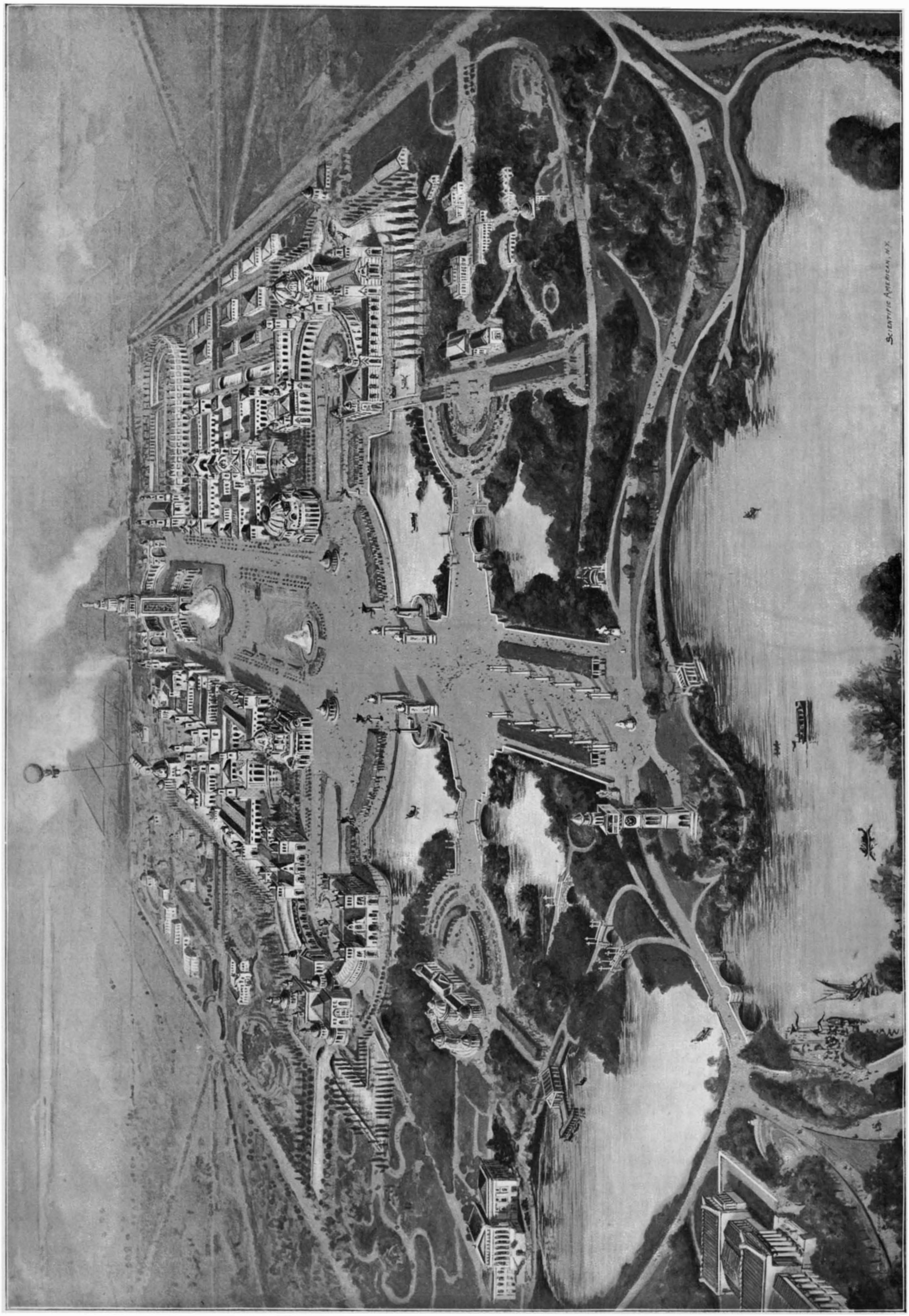
The maintenance of beaches along the New England coast is being successfully accomplished by the "groyne system." These "groynes" consist of a series of posts planted firmly in the sand, with close planks extending from post to post. The "groyne" is constructed at right angles to the beach, and its position prevents the waves acting on it injuriously. Sand is intercepted by the planking, rapidly forming a new beach and preventing erosion.

It might be interesting to our readers to know that in the large modern sailing vessels having six masts the names are as follows: The first is called the foremast; second, the mainmast; third, the mizzen-mast; fourth, the spanker-mast; fifth, jigger-mast; and sixth, driver-mast. In placing the masts the foremast is usually put about 24 feet from the end of the keel, and the driver 50 feet from the after end of the keel. The intermediate masts are spaced at the same distance.

The German pencil trade is suffering severely from competition of American lead pencil makers. The ingenious labor-saving machinery of American factories and their large scale of production, and specially cheaper prices at which they can supply themselves with cedar wood, are the chief causes for the failure of German makers to hold their own. The fact is that Germany is practically dependent upon the United States for her supply of cedar and the best of the wood is kept in America.

The forts at Dover (England) have been recently rearmed with quick-firing, long-range, 6-inch wire-wound guns. During the experiments, however, five of them were discovered to be defective, and were immediately removed to Woolwich, and others mounted. Great secrecy has been maintained regarding the nature of the defects, but it is supposed to have existed in the breech. These unwieldy weapons have to be hauled from the landing stage in the harbor to the summit of the cliffs, a total distance of two miles.

An extraordinary accident occurred at Buffalo November 18. Fifty-thousand tons of iron ore piled on the Minnesota docks sank out of sight, owing to half of the dock, 600 feet, giving away, and the entire dock was wrecked. The ore continued to sink all day long, and thirteen hours after the accident it was 8 feet below the surface. The cause of the cave-in is a mystery. Borings for 30 feet showed nothing but solid clay and there was no fear of a quicksand, but it is probable that this is what caused the collapse. The docks were equipped with the most modern ore-handling machinery, and the loss is almost a total one.



BIRD'S-EYE VIEW OF THE PAN-AMERICAN EXPOSITION.

BIRD'S-EYE VIEW OF THE PAN-AMERICAN EXPOSITION.

We have so recently (November 10 and November 24) described and illustrated the general scope and the recent progress of the Pan-American Exposition that the accompanying bird's-eye view will be perfectly intelligible to our readers without any lengthy elaboration on our part. The point of view is supposed to be an elevation beyond the water gate, at the extremity of the large lake, which will form one of the most delightful landscape features of the Exposition. The Lake, including the North Bay, is approximately three-quarters of a mile in total length, and its sloping and gently undulating shores will be richly wooded down to the water's edge. To the left of the lake is seen that architectural gem, the Albright Art Gallery, its gray-white marble walls and columns showing in vivid contrast amid its setting of greensward and foliage. Descending the broad marble flight of steps and turning to the left over a bridge which separates the main lake from what is known as the North Bay, one sees across the latter sheet of water another marble building, not so large as the art gallery, but scarcely less charming in its architecture and landscape setting.

After crossing the bridge, and swinging somewhat to the right, one enters the magnificent main approach to the Exposition buildings, and the eye ranges through the long perspective of the Fore Court, the vast Esplanade, capable of holding a quarter of a million people, the Court of Fountains and the Grand Basin until it is arrested by the towering mass of the noble Electric Tower—the dominating architectural feature of the whole Exposition. To the right of the approach are the Ordnance exhibits, and adjoining them the numerous groups of buildings devoted to State and Foreign exhibits. Following down the main approach and through the Fore Court, one reaches the ornamental bridge which leads into the Esplanade. Inclosing the right wing of the Esplanade are the United States Government buildings, and the left wing is shut in by the Forestry and Mines building, the Horticultural building, the Graphic Arts building and the Temple of Music. Passing through the Esplanade, whose shorter axis measures 450 feet and its longer 1,700 feet, the visitor is confronted by the Fountain and Cascades, which, together with their setting of greensward and flower beds, extend down the main approach for 700 feet. Beyond the Cascades is the Mall, a broad, imposing concourse, extending entirely across the grounds, which measures 150 feet in width by 2,640 feet in length. Here one is confronted by a sheet of water 350 feet by 400 feet in length, from which there towers nearly 400 feet into the air the massive and pre-eminently graceful structure of the Electric Tower. To the right and left of the Cascades are the buildings devoted respectively to Manufactures and Liberal Arts and to Machinery and Transportation, each of which is 350 feet in width by 500 feet in length. At the back of the Liberal Arts building is the stock exhibit, while to the rear of the Transportation building are grouped in one structure the various offices of the administration. To the right of the Electric Tower is the building, 500 feet in length, devoted to Agriculture; while to the left of the Basin is another building of similar dimensions devoted to the Electrical exhibit. Behind the Electric Tower is the Plaza, surrounded by restaurants and the Propylæa, while immediately behind the Propylæa is the general station of the steam and electric railways. By no means least among the attractions of the Pan-American Exposition is the structure which will be given up to athletics and general outdoor sports, known as the Stadium. The major axis of the Stadium will be fully 750 feet in length and its minor axis 500 feet. The arena will be laid out as an athletic field and will be surrounded by a track for contests of speed. Seating accommodation will be provided at two sides and around one curve of the track for 12,000 people. On the opposite side of the Plaza to the Stadium will be the Midway, without which no end-of-the century exposition seems to be complete, if, indeed, judged by its popularity, it must not be considered its leading feature.

The present progress in the construction of the buildings and that essentially novel feature the color treatment, have been very ably dealt with in our recent articles contributed by Edward Hale Brush; and after studying the accompanying bird's-eye view, our readers will agree with him that the combination of the delicate, tastefully-tinted buildings with the broad plazas, the generous expanse of greensward and shrubbery, and the various carefully elaborated elements of the landscape gardening, will produce a *tout ensemble* which will give the Pan-American Exposition the leading place for beauty among the great expositions of the closing years of the present century.

DR. EDUARDO CHAPOT-PREVOST.

THE Say sugar refinery in Paris is using the 20 ton electric truck for the transportation of sugar. It is intended to carry a 9-ton load, although it has carried 17 tons. It is capable of a speed of 7½ miles an hour, and 25 miles can be made without recharging. Electric motors are used to steer the two front wheels. The company will, it is said, order ten other trucks of similar construction.

Fig. 3.—ANTERIOR VIEW OF CRUVEILHIER'S FŒTUS.

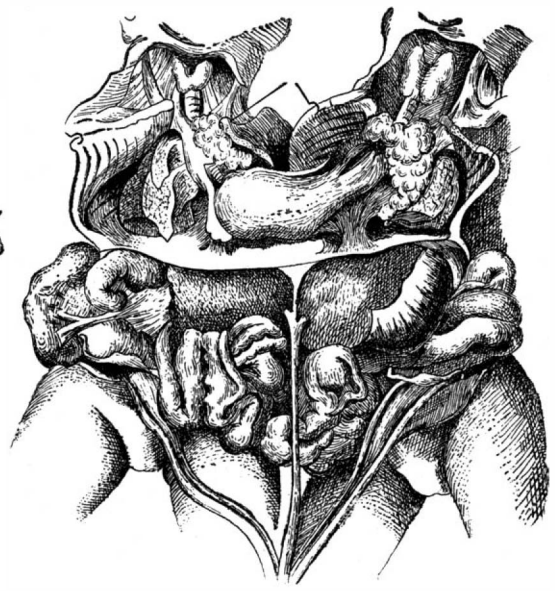


Fig. 4.—THORACIC VISCERA OF CRUVEILHIER'S FŒTUS.

SEPARATION OF THE BRAZILIAN THORACO-XIPHOPAGOUS TWINS.

The thoraco-xiphopagous twins of Brazil, who have attracted no little attention during the past year, have been separated by one of the most remarkable surgical operations chronicled within recent years.

In the SCIENTIFIC AMERICAN of February 24, 1900, we published an account of the preliminary operation performed by Dr. Alvaro Ramos, surgeon of the Hospital Misericordia, of Rio Janeiro, which revealed the fact that the livers of the two girls were united. Before undertaking this operation, an excellent radiograph was obtained, for the purpose of ascertaining as far as possible the exact location of certain internal organs. Strong doses of hyponitrate of bismuth were administered to the patients. Owing to its opacity to Roentgen rays, this substance was revealed in the stomachs and in portions of the intestines, thus proving that there was no connection of these organs in one abdominal cavity. A reproduction of this radiograph was published in the issue above mentioned. When Dr. Ramos discovered the serious nature of the operation that would be necessary to effect the severance of the two bodies, he concluded that for the time being the investigation should be carried no further. Valuable indeed was the information obtained at this operation, and Dr. Chapot-Prevost, lecturer of the Academia de Medicina, of Rio de Janeiro, decided to undertake a second and final operation.

Dr. Prevost first determined whether the liver could recuperate and whether hemorrhage could be controlled. Careful experiments with dogs proved that the liver healed readily, and grew with an astonishing rapidity. A careful physiological and psychological study of the twins convinced him that an operation might be successfully performed.

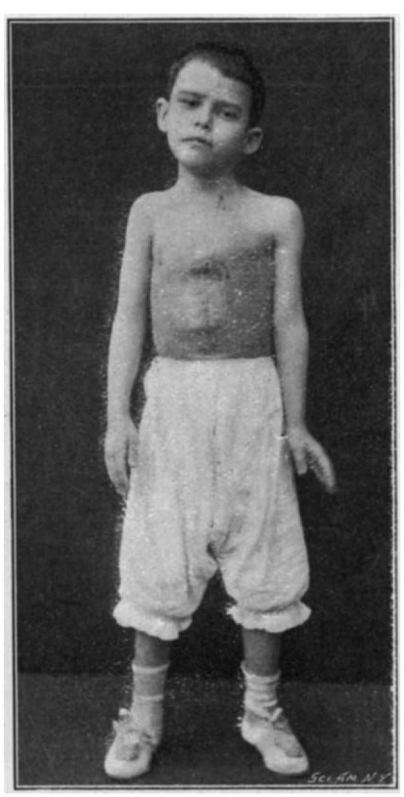
The modern surgeon has been taught by long experience that too much care cannot be taken in preserving the most perfect asepsis. In the present case the most elaborate preparations were made. The attendants took disinfecting baths, dressed themselves in new clothes thoroughly sterilized, and washed their hands and arms in six disinfecting solutions before entering the operating room.

The twins were prepared for the operation with the same elaborate precautions. They were washed with soap and water and with sulphuric ether, and were then wrapped in sterilized cotton covered with gauze. A specially devised operating-table was employed, so constructed that it could be separated into two parts.

The first incision made extended from the navel upward, its middle lying at the ensiform cartilage, near the false ribs of the right side of Maria. The anterior superior surface of the liver was exposed, when the flap was turned back toward Rosalina. It was found that the liver bridged the two cavities and occupied two-thirds of the connecting space. Below this bridge was a second bridge formed by the union of the two mesenteries. After the cartilage in the median line had been severed, still another bridge two centimeters long was discovered, formed by the union of the two pericardial sacs. The separation of this third bridge was a most delicate task. When the anastomosing branch of the two mammary arteries was severed, the blood streamed out in a red deluge. The points were seized and the hemorrhage controlled. The imprisoned tissue was cut, and the edges of each sac sutured with cat-gut. To prevent the intestines of the one body from passing into the other body, the mesenteric bridge was ligated with silk at two points; the intermediate portion cut, and the intestines placed in their proper positions. The pleura of Maria, it was found, extended across the line of union. This unforeseen difficulty was overcome by detaching the parietal pleura, and connecting it by means of a fine cat-gut suture with the median fold, which adhered to the pericardial bridge.

After the internal parts of the thorax had been thus separated, operations on the other side were begun. The skin and cartilage opposite the first incision were severed to expose the liver. Skilfully the surgeon cut the liver so as

THE TWINS BEFORE THE OPERATION.



ROSALINA AFTER THE SEPARATION.

to give each trunk an uninjured gall-bladder and duct. The final suturing was done on two planes, the deep peritoneal and the superficial, including the skin and muscular coat.

Fig. 1 shows the point of separation. The severed surface of Rosalina's liver is represented by *a*; *b* is the visible part of Rosalina's gall-bladder; *c* is the pectoral cavity of Rosalina, which communicated largely with that of Maria; *p* is the circular limit of the bridge of the pericardium cut vertically; *pl* is the case of the pleural sac, extending from the side of Rosalina beyond the point of union; the xiphordian appendix is represented by *ap p* and *app'*.

The condition of Rosalina after the operation was encouraging; that of Maria, less hopeful. On the second day after the operation, Maria's pulse ran up to 160, her respiration to 56, and temperature to 38·5° (C.) The condition of both children improved on the third day; but it was necessary to give Maria inhalations of oxygen at midnight. On the fourth day Maria was weak and could take no nourishment; but she improved after oxygen had been administered. The fifth day saw Rosalina in good health, and Maria improved. In the early part of the sixth day Maria seemed in so favorable a condition that she was pronounced out of danger; but fits of vomiting, although checked, weakened her so much that she was unable to rally under the supportive treatment given her. She died at 1:30 A. M. of the following day. An autopsy revealed an inflammation of the pleura and pericardium, with more or less exudate from each, but no inflammation of the peritoneum. The liver as well as all the external wounds were completely healed.

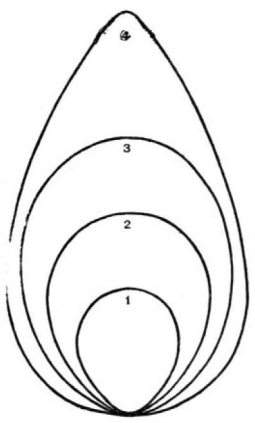


Fig. 1.—COMPARISON OF NOTABLE XIPHOID CASES.

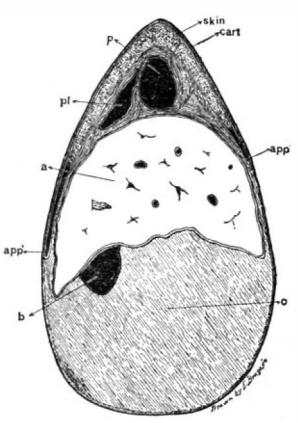


Fig. 2.—DIAGRAM SHOWING THE POINT OF DISSECTION OF ROSALINA AND MARIA.

Drawn especially for the SCIENTIFIC AMERICAN under the supervision of Dr. Chapot-Prevost by Prof. E. Braga.

Rosalina is now in excellent health. On August 16 she sailed with Dr. Prevost for Bordeaux.

Remarkable as the case of these twins may be, it is not the first of its kind known to medical men. As far back as 1834, Cruveilhier studied a double female fœtus brought to his attention by a Dr. Jolly. This curious phenomenon is shown in Fig. 3. The thoracic viscera of this fœtus are shown in Fig. 4. The twins were joined at the anterior portion of the trunk down to the sub-umbilical region of the abdomen. The two sterna were entirely independent of each other. Each fœtus had a thymus and two lungs; but the two hearts were merged into a single organ, horizontally located and imperfectly symmetrical. The right half of the heart was inclosed in the thoracic cavity of the right fœtus; and the left half in the thoracic cavity of the left fœtus. The upper concave portion conformed with the base of the thorax on the line of the xyphoid appendices; the lower concave portion rested on the diaphragm. There were four auricles—two on the right (an upper and a lower), and two on the left. The upper left auricle and the lower right auricle were much larger than the other two. In the illustration the aorta of the right side and the aorta of the left, the vena cava superior and inferior, are clearly shown.

A single diaphragm formed by the union of the two diaphragms was pierced by the two inferior vena cava.

There were two stomachs, two duodena, two pancreas, two ilea, two cœca, two appendices, two large intestines. But there was only one jejunum and one liver, with the anterior and posterior portions located, strange to say, in the epigastric region.

The case of Cruveilhier's twins in certain respects is similar to that of Rosalina and Maria.

In Fig. 1 we have graphically compared the most important xyphoid cases which are recorded in the history of medicine. The diagram indicated by 1 represents the case of Marie and Adele; 2 pictures the case of Chang and Eng; 3, that of Rodica and Doodica; 4, that of Maria and Rosalina.

In conclusion we desire to express our acknowledgment to E. Braga, Jr., formerly professor of mathematics in the College of Braga and professor of history and natural science in the College of Cuanberg at Rio de Janeiro, for information from which the above article was prepared and for the photographs and drawings which he has kindly furnished us. The drawings were made by Prof. Braga especially for publication in the SCIENTIFIC AMERICAN.

III. SIMPLE ELECTRIC MOTOR.

BY GEORGE M. HOPKINS.

Almost every young amateur mechanic is desirous of making something having the ability to move and show action. An electric motor does this; and while the mechanic is making a good piece of machinery, he is also learning the principles of electricity.

The motor we shall describe is intended to turn a fan or light machinery by means of a current derived from a battery. It will drive a light sewing machine or other machinery requiring a similar amount of power, and it is so simple as to admit of being constructed with the tools ordinarily possessed by an amateur.

To begin a motor at the right point is very important. The first thing to be done is to construct the armature—the part which revolves. On account of its simplicity, we have selected the Gramme armature.

The core of this armature consists of a ring formed of No. 24 sheet iron. A strip ¾ inch wide and 8 feet long (the length of a sheet) is carefully cut from the sheet and wound upon a cylindrical piece of wood in the lathe or by hand. The wood cylinder is 1¾ inches in diameter and 1 inch thick, and in the edge is cut a shallow notch of a depth equal to the thickness of the sheet iron, as shown in Fig. 2. In the iron, ⅛ inch from the end, is drilled a hole countersunk to receive a wood screw which passes through the sheet iron into the wood, and fastens the end in the notch in the wood. The sheet iron thus attached to the wood may be wound closely around the wooden mandrel without a kink being formed by the inner end of the strip, which is in the notch.

Before beginning the winding, a piece of strong annealed wire, stove-pipe wire for example, is placed in a handy position, and when nine layers of the iron have been wound the strip is cut off and the binding wire is wrapped around the coil and twisted together at the ends, to keep the sheet iron from unwinding.

The wood and the coiled sheet iron are together removed from the lathe (or vise if it is being done by hand), and placed in a fire, which will heat the iron to a cherry red and burn out the wood. The ring is then covered with ashes and allowed to cool slowly. This anneals the iron, and improves its magnetic permeability.

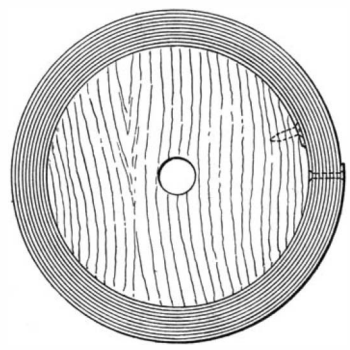
After removal from the ashes, and while the binding wire is still in place, the ends are secured by passing rivets through them; the inner end, which was bent, is cut off, and the ends are beveled with a file, and all the sharp corners are reduced by the same means.

The core of the armature is then covered with adhesive tape (either electrical or bicycle tire tape), when it is ready to receive the magnet wire with which it is to be wound. The ring is divided into five equal sections, and marked with a pencil to show how much space each coil of the armature is to occupy. There are five coils on the armature, with five layers in each coil. No. 21 single or double cotton or silk covered wire is used. It requires about 28 feet of wire for each coil. The winding is a slow and rather laborious process. The length of wire for a coil is wound on a sort of shuttle-stick ¾ inch wide, 12 inches long, with a notch in each end. The end of the wire is wrapped twice or three times around the ring over a piece of stout thread, which is tied around the wires to fasten them together, to begin a coil. Of course, the beginning is at one of the marks on the ring.

Now the shuttle is passed through the ring and brought back over the outside until one layer covers one space; then commencing the winding over the first layer the second is laid on, then the third, fourth, and fifth; all the layers are wound in the same way. The last three or four turns are made over a stout thread, which is tied when the last convolution is made.

The other coils of the armature are made in the same way; and when the winding is all on, the end of one coil is twisted with the beginning of the adjacent coil. A piece of well seasoned hard wood, hard maple, for example, is bored to receive a piece of $\frac{3}{16}$ inch drill rod—Stubs or something equally good—which constitutes the shaft. This rod is 4 inches long. A $\frac{1}{16}$ inch hole is drilled transversely through it at or near the center to receive a short pin which enters a slot in the end of the wooden hub.

This piece of wood is turned to fit the interior of the armature, and it is cut off about the same length as the armature. The coils of the armature and the wooden hub are now varnished with thin shellac varnish, and allowed to dry thoroughly. The armature ring is then slipped into its place on the wooden hub, and the hub and the ring are coated with two coats of shellac varnish, one coat being allowed to dry before applying the other.



THE ARMATURE CORE.

The next thing to claim attention is the commutator. This is a core of wood fitted to the armature shaft and turned to fit a piece of brass or copper tube $\frac{5}{8}$ or ¾ inch in diameter and ¾ inch long. This tube is divided into five divisions, and parallel lines, preferably slightly spiral, are drawn from the divisional points marking the places where the tube is to be sawed to form the commutator bars. But before sawing, each end of each space which is to form a bar is drilled, and the hole is countersunk to receive a small wood screw, which passes into the wood and holds the bar in place when the brass tube is sawed on the lines to separate the bars. After sawing, the commutator is turned smooth and round, or filed in the lathe with a smooth file. The screws used in fastening the commutator bars must not touch each other or the shaft.

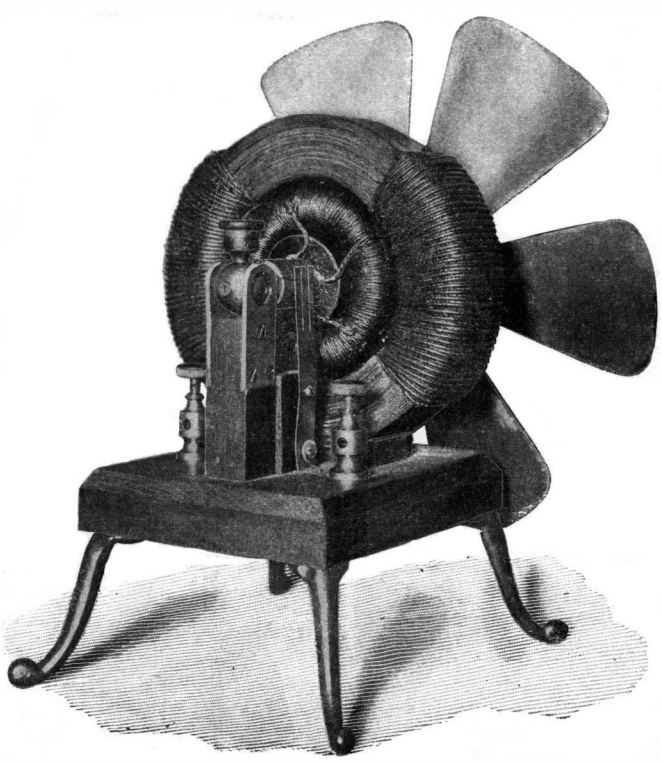
The twisted terminals of the coils are now stripped of the winding at the ends and soldered to the commutator bars, having been cut off the proper length to reach to the commutator.

Before soldering, however, the ends of the terminals and a small portion of each commutator bar are tinned to facilitate the work of soldering. To tin the copper wire, a little pulverized rosin is rubbed on the ends of the wires, and the solder is applied with a soldering iron.

The commutator bars are tinned for ⅛ inch at the ends nearest the armature ring in the same manner.

The terminals of the armature coils are bent so as to touch the commutator bars at the tinned surfaces; the beginning of one coil and the end of the adjacent coil being thus brought into contact with a commutator bar. They are then soldered by applying a drop of solder by means of the soldering iron. The wires are thus made to answer the double purpose of conveying the current to the commutator bars and of causing the commutator to revolve with the armature. Acid must not be used in soldering electrical connections.

To run smoothly, the armature must be in balance. To ascertain whether it is in balance, place the armature shaft on the edges of two level straight-edges supported about 4 inches apart. If the armature will stand in any position, it is balanced. If it rolls so that one side after a few oscillations of the armature goes to the bottom, the top must be made heavier to counterbalance the bottom. Probably the best way to add weight to one side of the armature is to apply it in the form of solder to a band of wire about ⅜ inch wide wound around the armature. Before this winding is applied, a strip of mica ⅝ inch wide must be wrapped around the armature and secured in place by shellac varnish applied to both the armature and to the mica and allowed to become nearly dry. It is not necessary to use a



ELECTRIC MOTOR.

continuous piece of mica; it may be in several pieces. When the armature comes to rest after oscillation, solder should be applied to the upper side of the wire band until the armature will stand in any position. If too much solder is applied, the surplus may be removed by a coarse file. It is important to have the armature as nearly in balance as possible. It will then have very little vibration, or none at all, while running at any reasonable speed.

The description of the field magnet and other parts will be given in an early issue.

Pneumatic Railway Signaling in England.

The London and South-Western Railway, one of the principal railroads in Great Britain, is about to introduce upon its system the pneumatic process of railway signaling, which has been employed with such conspicuous success upon our own railroads for several years. Some time ago Mr. Fay, the superintendent of the line, visited this country, and studied the principles of this system at Buffalo and other large centers, where the congestion of the traffic renders it absolutely imperative that the work of signaling should be rapid, perfect and free from fatigue. In England, at the important termini and busy junctions, the signalman's duty is extremely arduous, the incessant throwing of large, heavy and complicated levers conducing to great fatigue. The simplicity of the pneumatic system was impressed upon Mr. Fay, and when he returned to England he lost no time in recommending its adoption upon his own railway. The first installation will take place at the important junction Basingstoke, and it will be in working order in the course of a few weeks. After the apparatus has proved successful at this station, it will be introduced at the London terminus Waterloo, the largest and busiest station in Great Britain. At the present time several extensions of the railroad are in operation—the road is being doubled throughout the whole route, and Waterloo terminus is to be considerably enlarged—while others are in contemplation. The present is thus an appropriate moment for the introduction of the pneumatic signaling apparatus.

Owing to the stringent regulations of the Board of Trade, by which all arrangements for the safe conveyance of passengers are controlled, such an innovation as this cannot be made without mature consideration. For instance, the distance by which switches and signals may be actuated from a signal cabin is appointed by this department of the state, and should the distance exceed the limit, then an additional signal box has to be constructed.

The introduction of the pneumatic signaling, however, will be far-reaching in its beneficial effects. Under the existing circumstances the signals and points are manipulated by means of wires, rods, and cranks, and where the yards and junctions are busy these constitute veritable death traps.

It is anticipated that the new system will lighten the labors of the signalman, and enable him to concentrate his mind upon his duties. It will be cheaper to maintain, since it cannot get out of order or become damaged like the mechanical apparatus now in use; it is not affected by the weather, and requires no adjustment. Also the numerous brackets for bells and devices for indicating or repeating the signals may be dispensed with. The economical working of the apparatus and its efficacy have been assured upon this side, so that the decision of the English railroad company is by no means to be considered in the light of an experiment. The innovation will be followed closely by the various other railroads in the country, and, if successful, its universal adoption in Great Britain is bound to ensue.

Coal in Japan.

The development of the coal mining industry in Japan is remarkable. A few years ago that country was dependent upon other countries for this article in order to drive industrial machinery, to provide fuel for her merchant marine and her navy. Now this order of things is completely changed. Sufficient coal can be obtained from the native mines to supply the whole country's necessities. The principal coal mining centers are in Hokkaido or northern island and in Kynshu in the south of Japan. Some idea of the present proportions of the industry may be gathered from the fact that the Hokkaido Colliery Company during the first six months of the present year earned a profit equivalent to about $775,000. Of this amount, $160,000 was set aside for the purpose of installing the necessary plant to manufacture coke, since the coal has been found to be excellent for this purpose. But the high price of European coal has caused considerable discontent in mining circles in Japan. At the present time Cardiff coal on the Japanese market is sold at $22 per ton, while the native product fetches only $6 per ton. This state of affairs has been proved to be entirely due to the reckless competition that exists among the small coal merchants; and with a view to surmounting the difficulty, it was decided to form a combination among the colliery owners, and to suspend the sale of coal for two months, so that a consequent rise in price might ensue in the retailing of the coal. It was also decided that the minimum price of the coal be increased to $8 per ton. For a short time, therefore, Japan will suffer from a scarcity of coal, an effect which the colliery owners anticipate will result in a substantial increase in price.

The Current Supplement.

The current SUPPLEMENT, No. 1301, is a particularly interesting number, the first page engravings dealing with the Pavilion of Bosnia-Herzegovina at the Paris Exposition. "High Water Protection Methods on the Lower Mississippi River" is by William Joseph Hardee. "The New Elevators of the Eiffel Tower" are described and illustrated. "Electrical Engineering as a Trade and as a Science" is by Prof. John Perry. "The Population of the United States During the Next Ten Centuries" is by H. S. Pritchett, the new president of the Massachusetts Institute of Technology. "The Late Prof. Max Müller" is the subject of an interesting biography. "Condensed Information Concerning Some of the More Valuable Insecticides" gives many formulas for remedies for insect pests. "Tropical Hurricanes" is by F. J. B. Cordeiro. "The Cradle of the Human Race" is a most fascinating scientific article.

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(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

DISK-CULTIVATOR. — LINDEN KIRLIN, Beattie, Kans. The disk comprises an open rim or ring and a supporting-frame. A body-plate is held detachably in the ring, whereby it may be removed and applied to convert the disk into an open or closed one. By providing this closing mechanism, the disk can be closed in going over the corn the first time, and set to throw the dirt away from the corn. The disk is solid, so that it will move all dirt away from the corn; but the second and third time, the dirt is thrown toward the corn with the disk half-open.

COMBINED HOE AND WEEDER. — GLENN A. MORRELL, Grand Rapids, Mich. This implement comprises sides; a back; a cutter-blade at the front; and spaced wires stretched from the blade to the back to form a perforate bottom. As the scoop, thus constituted, is pushed forward, the weeds are cut by the blade and fall into the scoop, the dirt dropping through the perforated bottom.

Engineering Improvements.

INSTANTANEOUS STEAM-GENERATOR. — CHARLES L. PALMER, Albany, N. Y. Within each generator-tube is located a solid rod of a somewhat smaller diameter than the bore of the tube. In the annular chamber thus formed is located a spirally-disposed wire or rib, continuous or interrupted. The spiral rib lengthens the path of the water and thus secures a more energetic vaporization. The interior core or rod, being solid, has a large heat-retaining capacity.

Mining Apparatus.

CONCENTRATING-TABLE. — IRA F. MONELL, Boulder, Colo. The concentrating-table is mounted to have lateral motion and is provided with a series of diagonally-arranged channels. Pins extend upwardly from the table above each set of channels; and fixed riffles are arranged at one side of the series of chambers. The heavier particles will tend to move toward one side of the table; and the very light material, with the water, will pass over the tailpiece into the fine channels or grooves of the table; and from these fine channels, the material is deposited into larger, deeper grooves. Some of the material and sand, however, will pass to the upper sides of the riffles and form sand cushions through which the excess of water will pass and discharge over the tailpiece.

Mechanical Devices.

WATER-SUPPLY REGULATOR.—FREDERICK S. SEYMOUR, Dubuque, Iowa. The purpose of the invention is to provide means for controlling the supply of water to a tank or other receptacle. The apparatus has cut-off devices in connection with water forcing or supply apparatus. In the construction a pan is included in which the water backs from the trough when full, so that when the pan drops by the weight of the water, the cut-off devices will be operated.

CONTROLLABLE BALLOON.—LEO STEVENS, Manhattan, New York city. From the cigar-shaped gas-bag of the balloon a rigid beam is suspended. The flexible connections between the two sustain a parachute. From the beam a car is supported carrying motors for the purpose of driving propellers. Rudders are provided to steer the balloon. A slidable weight on the beam enables the aeronaut to direct the air-ship up or down.

SNOW-MELTER.—JACOB MANDREY, Bronx, Manhattan, New York city. The snow-melter comprises a frame mounted on wheels, with a furnace arranged to swing in the frame and provided with a downwardly-inclined forward portion through which the products of combustion pass. Sprocket-chains at opposite sides of the furnace are provided with scrapers which serve the purpose of carrying the snow to the furnace as the machine is moved forward. The sprocket-chains are driven from the rear wheels.

COMBINATION-LOCK.—WILLIAM E. H. MORSE and OLIVER H. BEMIS, Algona, Iowa. The invention provides a new and improved combination door-lock and knob arranged to work the door-lock by the use of the outside knob, which latter is adapted to be set to any desired combination to prevent unauthorized persons from opening the door and to allow the owner readily to unlock and open the door without the use of a key.

CLIPPER.—ALLAN QUARRIE, Oak Lake, Manitoba, Canada. The purpose of the invention is to provide a clipper especially adapted for removing or clipping hair from animals. The cutter-plate is operated by the handles, when placed in any one of three positions. One of these positions is that known as "straight" or at right angles to the cutting-face of the machine. The second position is at the right-hand side of the cutting-face. The third position is at the left-hand side of the cutting-face. The machine can therefore be used on all portions of an animal's body and limbs.

REGISTERING-DEVICE FOR POOL GAMES.—WILLIAM TABER, Poughkeepsie, N. Y. Each time the triangle is removed from its rack or support, a game will be registered by suitable mechanism carried by the rack or support. The rack or support is also provided with means for registering a series of games. A mechanism is also furnished, through the medium of which the number of players in a game can be indicated and the record of each made upon a concealed tape. The merits of the invention are obvious.

FABRIC-STRENGTH-TESTING DEVICE. — WILLIAM M. VERMILYE, New Brighton, Richmond, New York city. The machine consists of a frame in which two sets of jaws are mounted for clamping the fabric. The one set of jaws is shifted outward or inward by screw-actuated rods moving in the frame; and the other set of jaws is connected with a coiled spring and with a rack engaging a pinion upon the shaft of which the index finger of a scale is mounted. The fabric is clamped in place; the jaws separated from one another; and the breaking strain is registered on the scale. A magnifying glass is provided for examining the stretched fabric. The device may be made small enough to be carried in a pocket.

Railway Appliances.

SWITCH-CONTROLLING DEVICE FOR SURFACE CARS.—CHARLES G. BAUER, New Rochelle, N. Y. The device is carried by the car and is designed, when operated, to throw a switch from the car. Such arrangements have been already invented; but the present device differs from most of them in so far as it is automatically released after the switch has been set. Other features of interest and merit are the simplicity of construction and ease of operation.

MAIL-CATCHER.—CHARLES C. COLEMAN, Keytesville, Mo. By means of this novel device a mail-sack at a station can be transferred from a holding device to a moving mail-car or from the moving car to the holding device, or for simultaneously transferring from one device to the other. The catchers on both car and station consist of bifurcated arms and rings from which the mail-bags are suspended. The arms catch their respective rings and the mail-bags are transferred.

VENTILATING ATTACHMENT FOR RAILWAY-TUNNELS.—JAMES J. SWAINE, 1918 Mt. Royal Terrace, Baltimore, Md. To remove smoke and cinders from tunnels, a supplemental arch or roof is provided, which is arranged longitudinally and transversely a short distance below the true arch or roof. This supplemental arch has a lengthwise opening in its highest part, through which smoke and cinders are discharged by the locomotive-stack. The gases are condensed, concentrated, and removed.

Vehicles and Their Accessories.

AUTOMATIC TIRE-INFLATING DEVICE.—THOMAS H. MCCAULEY, Port Arthur, Ontario, Canada. The tire is provided with a bulb coacting with an air-inlet having a check-valve. When the rotating tire receives the load strain, it will be somewhat flattened at the point of its contact with the ground. In this position the bulb will be compressed, the check-valve closed, and air will be pumped into the tire.

DRIVING MECHANISM FOR MOTOR-CYCLES OR MOTOR-CARS.—PROSPER A. RENAUX, Rue du Repos 33, Paris, France. The motor is made to operate the driving-axle by means of a special arrangement which takes the place of a differential gear for the motor-axle. This special arrangement consists of two shafts with a fly-wheel loosely mounted on each. A sleeve connects the fly-wheels; and in the sleeve a pinion is contained. On each of the shafts a pinion is rigidly mounted, one of these pinions engaging the pinion in the sleeve directly. A loose pinion engages the pinion on the other shaft and the pinion in the sleeve.

WHIFFLETREE. — ALBERT NELSON, Idaho Falls, Idaho. The invention relates to a class of whiffletrees provided with attachments adapted to release the traces or tugs when traction is applied. The whiffletree has tug-clips at its ends with spring-bolts carried in the clips and provided with pulleys journaled on their inner ends. A cord passes over the pulleys, and is secured at its ends to the whiffletree at points intermediate of the bolts and pulleys. A pull-cord is attached to the cord and is connected to the bolts. The effect of the tractive force applied to the cord is practically double that produced when the ends of the cord are attached directly to the bolts.

Miscellaneous Inventions.

CARBURETER.—HENRY BURTON, Russellville, Ind. This gas-machine comprises a coil through which gasoline or the like flows. Below the coil is a burner for vaporizing the gasoline. The coil is connected with an expansion-chamber. Above the expansion-chamber is a casing provided with an injector-pipe. A valved air-supply pipe extends laterally from the casing. A gasometer receives the gas. Levers operate the valves from the gasometer-bell. As long as there is any gas in the gasometer, it will be necessary merely to light the burner in order to start the machine.

SLUICE-GATE.—AUGUSTUS PRESCOTT, Salem, Ore., and LEWIS I. FURBER, Winlock, Wash. The gate is particularly adapted for small streams where the natural flow of water is not sufficient to make the stream serviceable for logging without first building a separate dam to hold enough water. In this sluice-gate, casings are employed, terminating in forebays at the downstream end. Water-inlet sluices lead through the casings and into the forebays. Valves are provided for the sluices. Outlet-sluices lead from the forebays and are likewise provided with valves. Gates are pivoted at the downstream ends of the casings. Wings extend from the gates and operate in the forebays, the wings having a greater area than the gates. By reason of this greater area, the pressure of water flowing into the forebays will act to move the gates to a closed position against the water resistance.

Designs.

TOWEL-HOLDER. — LOUIS MCCUTCHON, Havana, Cuba. This towel-holder is a clamp made in the shape of a bottle and is designed to be used in barber-shops.

HEADPIECE FOR GRAVES. — EMIL BICK, 521 Seventh Street, Buffalo, N. Y. The head-piece is in the form of a Greek cross. Its foot is pointed, so that it may be forced into the earth, and radial arms are provided to rest on the surface and thus assist in supporting the head-piece upright. Sockets for flower-pots are formed in the top of the central part and also in each of the horizontal arms. A chamber, closed by an ornamental panel, is arranged in the vertical part.

TOBACCO-MOISTENER. — SIGISMUND STRAUSS, Manhattan, New York city. The design provides a moistener comprising a triangularly-shaped receptacle, the front of which is transversely curved and longitudinally tapering. The front is apertured.

BRAID.—LOUIS BRANDT, Manhattan, New York city. From a central loop section body-loops extend at each side, inclining in opposite directions from the side, but in direction of the same end of the central section. The body-loops are so arranged with reference to one another and with reference to the central section that they present in plan view a series of interlocking bow-ties.

HOOK. — FRANK KEMETHER, Glasgow, Del. A straight shank terminates at one end in an open hook and at the other end in a straight arm bent at right angles to the shank.

VERNIER-PLATE FOR SURVEYING INSTRUMENTS.—GEORGE L. BUFF, Boston, Mass. The inventor protects the ends of the level by arms rising from the plate.

SLIPPER ORNAMENT.—JOSEPH A. DALRYMPLE, Haverhill, Mass. The design consists of an ornamental casting simulating beads.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7994) P. B. J. asks: 1. What amount of wire is required, what size, and how is it to be wound to make a permanent magnet? Can I get sufficient power from batteries and induction coil, ½ inch spark, or from a uni-direction machine with 8 inch magnet? A. To magnetize a permanent magnet with a battery, wind a coil of covered wire of any convenient size, No. 14 or No. 16 will do. The inside diameter of the coil must be such that the magnet will slip easily through the coil. If of the horse-shoe form, it is well to make the coil so that the magnet may slide around through the coil for its whole length; otherwise, you can use the coil on each end separately, by breaking the circuit before removing the coil from the magnet. To use the coil, put it upon the magnet to the middle of the magnet and turn on the current. Move the coil along the magnet to one end and then to the other end several times, stopping at last at the middle. Break the circuit, and the magnet will be found magnetized. 2. Is a compound magnet simply several ordinary magnets put one on the other, or must they be insulated? Is the power of said compound magnets the power of all combined, or is it increased as in the induction coil? 2. A compound magnet is made from thin magnets of steel. Each one is carefully magnetized separately as strongly as possible. They are then assembled into one magnet by placing the same poles of all together. Thus the strength is made much greater than that of a single magnet of the same weight. 3. Will a dynamo with a permanent magnet do the same work as one using an electromagnet? I have an eight-foot windmill which pumps water from a well two hundred feet deep; there is plenty of power to spare while pumping, which is not over one-third of the time. Could I connect my mill with a small dynamo which is in turn connected with storage batteries for light? If so, how large must my dynamo be? I would like to burn four 16 candle power lamps. How many cells of battery must I have, their size, etc.? Could I use the unidirection dynamo for this? A. A machine with a permanent magnet will generate a current of electricity as well as one with an electro-magnet. It is not as serviceable. Such machines are not built except in small sizes. A dynamo can be run by a windmill, if a heavy balance wheel is used to equalize the velocity. A countershaft is necessary to give sufficient speed. A small dynamo is usually run at about 1,600 turns per minute. You will probably get eight to ten 16 candle lamps from a horse power. A storage battery will be needed to furnish light when the wind is not blowing. Your little dynamo with permanent magnet will not furnish the current for any number of lamps. Its voltage may not be right for lights. To light your lamps you will require as many cells of storage battery as one-half the voltage of your lamps. Their size will be determined by the number of hours they are to run on one charge. Consult our advertising columns for storage battery. 4. Situated as I am over a hundred miles from a foundry and machine shop, I have been forced to rig up a shop for repairing of all kinds of farm tools; instead of a forge I have two blast or brazing lamps. One of these lamps is rated at 2,600 and the other at 2,000 degrees. I feel positive if I can get the heat boxed up I can melt iron, brass, etc., for casting small pieces for experimental work; can you give me any idea of a furnace in which I can put my crucibles for this purpose? A. The lamps will melt a small crucible of metal. You can inclose the crucible in fire brick with an opening for the blast.

(7995) S. J. P. writes: I want instructions how to make a magic lantern; also a work on concave mirror reflection tricks. Some years since I had a lantern with a mirror in one corner, so that we could remove the lamp and throw a scene on to smoke, but I have forgotten the detail. We could apparently throw a scene through a wall and many curious things do that I have forgotten. Have you a work on anything of the kind? A. We know no book better adapted to your needs than Experimental Science, by G. M. Hopkins, price $4 by mail. It contains all that you ask and much more.

NEW BOOKS, ETC.

ENCYCLOPEDIA BRITANNICA. Thirty Volume Edition. The American Newspaper Association, 148 Fifth Avenue, New York city.

The Encyclopedia Britannica is one of the most imposing sets of books ever produced, and the solidity of the scholarship of its authors is only equaled by the massiveness of the volumes. Fifteen hundred of the greatest scholars in the world contributed to the production of this monumental work. The firm of publishers mentioned above, not satisfied with the parent work, have compiled a new American Supplement in five volumes, edited under the personal supervision of Dr. Day Otis Kellogg, assisted by a corps of such experienced writers and specialists as Dr. R. H. Thurston, Dr. Simon Newcomb, Gen. D. W. Flagler, Hon. Carroll D. Wright, Hon. John Sherman and many others. Many subjects not fully treated in the work proper have adequate representation here, such as for instance the biographies of living persons, which find no place in the original work. Such topics as the Philippines will be found here, and the information is exactly what the ordinary reader wishes to know. On the whole, the work is one which can be confidently recommended to a discriminating public.

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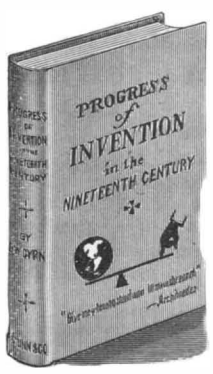

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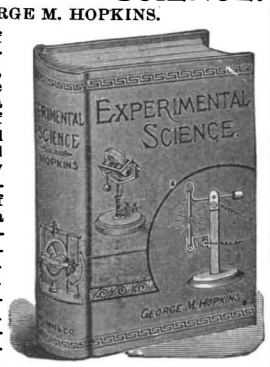

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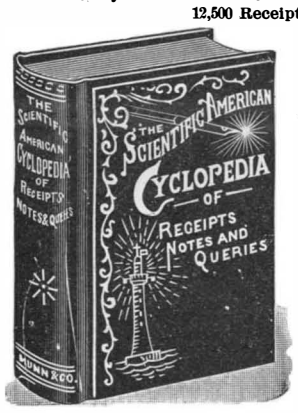

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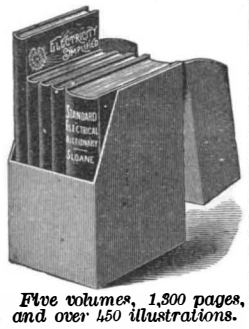

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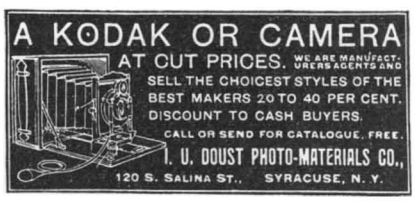

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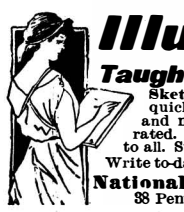

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